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ABSTRACT

This document contains an executive summary, main report, and detailed results by entry level of education, gender and ethnicity. The report examines the ways in which the State of Maryland economy benefits from the presence of the 16 community college districts in the state. Volume 1 is the Main Report, and Volume 2 includes detailed results. The colleges served an unduplicated headcount of 380,419 students in fiscal year 2002. The Maryland community colleges employed 7,026 full-time and 9,193 part-time faculty and staff in fiscal year 2002, amounting to a total annual payroll of some $507.7 million. The existence of the community college districts in Maryland account for a total of 4.2% of all earnings ($134.7 billion) generated from all sources in the region. The CC districts pay wages and salaries, which generate additional incomes as they are spent. Likewise, the aggregate college operating and capital expenditures generate still further earnings. Altogether, these earnings account for $755.4 million annually in the State of Maryland economy (equal to that of 22,378 jobs). Over the next 32 years, taxpayers should see a return of $15 for every dollar of state or local tax money invested in Maryland's CCs today. Students benefit from an annual return of 24% on their investment of time and money. The study also quantifies the effects of CCs on reduction of crime and welfare and unemployment. Appended in the Main Report are: Glossary of Terms; Explaining the Results--A Primer; Methodology for Creating Income Gains by Levels of Education; and Adjusting for the Benefits Available Absent State and Local Government Support. (Contains 54 references and numerous tables and figures.) (NB)

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The Socioeconomic Benefits Generated by 16 Community Colleges in Maryland

Executive Summary

[and]

Volume 1: Main Report

[and]

Volume 2: Detailed Results

Kjell A. Christophersen & M. Henry Robison

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MACC Maryland Association of Community Colleges

The Socioeconomic Benefits Generated by 16 Community Colleges in Maryland

State of Maryland

Executive Summary

June 30, 2003

Kjell A. Christophersen & M. Henry Robison

CCbenefits Inc.

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Executive Summary

HIGHLIGHTS

- The 16 community colleges in Maryland pay $507.7 million in direct faculty and staff wages, salaries, and benefits and explain an additional $5.1 billion in earnings off campus.
- Taxpayers see a real money "book" return of 11.9% on their annual investments in the community colleges and recover all investments in 10.2 years.
- Students enjoy an attractive 24% annual return on their investment of time and money – for every $1 the student invests in a college education, he or she will receive a cumulative $5.65 in higher discounted future earnings over the next 32 years.
- The state of Maryland benefits from improved health and reduced welfare, unemployment, and crime, saving the public some $73.7 million per year.

INTRODUCTION

How does the economy of the state of Maryland benefit from the presence of the 16 community colleges in the state? An obvious question often asked, but rarely answered with more than anecdotes. Maryland's 16 community colleges contracted with CCbenefits, Inc. to apply a comprehensive economic model they have developed to capture and quantify the economic and social benefits of community colleges (CCs). The model, which took over a year to develop with funding from the Association for Community College Trustees (ACCT), relies on data collected from individual CCs, and translates these into common sense benefit-cost and investment terms. It has been subjected to peer review, field tested on over 220 different CCs throughout the nation, and now applied to the community colleges in Maryland. Model results are based on solid economic theory, carefully drawn functional relationships, and a wealth of national and local education-related data. The model provides an analytical alternative from the all-too-common "advocacy analyses" that inflate benefits, understate costs, and thus discredit the process of higher education impact assessment.

Four types of benefits are tracked: (1) regional economic benefits (contributions to local job and income formation); (2) higher earnings captured by exiting students; (3) a broad collection of social benefits (improved health, reduced crime, lower welfare, and unemployment); and (4) the return to taxpayers for their support of Maryland's CCs.

THE RESULTS

For a more in-depth exploration of the study, the reader is encouraged to consult the Main Report containing the detailed assumptions, their context, and the computation procedures.

➢ Statewide Perspective

The 16 community colleges in the state of Maryland explain $5.6 billion of all annual earnings in the state economy (see map). The earnings explained by the colleges are equal to that of roughly

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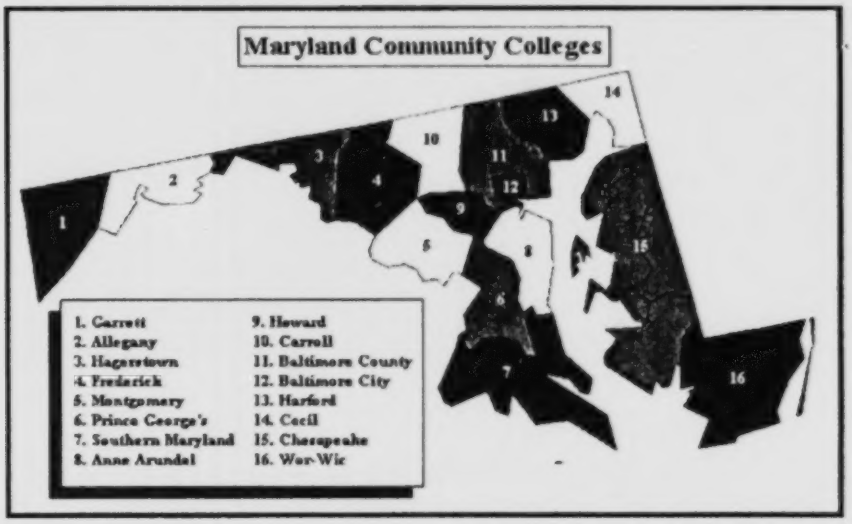
143,220 jobs. The earnings and job effects break down as follows:



- *Operations and Capital Spending*

Maryland's 16 community colleges pay wages, salaries, and benefits (i.e., earnings), which generate additional incomes as they are spent. Likewise, the aggregate college operating and capital expenditures generate still further earnings. Altogether, these earnings account for $755.4 million in the Maryland economy (equal to that of 22,378 jobs).

- *Higher Earnings due to Past Instruction*

Each year students leave the 16 colleges and join or rejoin the local workforce. Their added skills translate to higher earnings and a more robust economy. Based on current enrollment, turnover, and the growth of instruction over time, the workforce embodies an estimated 62.6 million credits of past instruction (credit and non-credit hours). The accumulated contribution of past CC instruction adds some $4.9 billion in annual earnings to the economy of the state of Maryland (equal to that of 120,842 jobs).

➢ **Student Perspective**

The student's perspective on the benefits of higher education is the most obvious: he or she pays tuition and foregoes current earnings for a lifetime of higher earnings. For every credit completed, students will, on average, earn $152 more per year each year they are in the workforce. Alternatively, for every full-time year they attend they will earn an additional $4,499 per year. In the aggregate (all exiting students), the higher earnings amount to some $546.4 million per year for each year they remain in the workforce.

From an investment standpoint, the CC students will, on average, enjoy a 24% rate of return on their investments of time and money, which compares favorably with the returns on other investments, e.g., the long-term return on US stocks and bonds. The corresponding benefit/cost ratio (the sum of the discounted future benefits divided by the sum of the discounted costs) is 5.6, i.e., for every $1 the student invests in community college education, he or she will receive a cumulative of $5.65 in discounted higher future earnings over the next 32 years. The payback period

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(the time needed to recover all costs) is 5.9 years.

➢ **Taxpayer Perspectives**

State and local government spent $458.8 million in support of the Maryland community colleges during the analysis year. Is this a good use of taxpayer money? Our analysis indicates that the answer is a resounding yes: returns far outweigh the costs, particularly when a collection of social savings is included in the assessment. For example, persons with higher education are less likely to smoke or abuse alcohol, draw welfare or unemployment benefits, or commit crimes. This translates into associated dollar savings (avoided costs) amounting to some $21 per credit per year, counted as an indirect benefit of CC education. When aggregated across all exiting students, the state of Maryland will benefit from $73.7 million worth of avoided costs per year, broken down as follows:

- *Improved Health*

Area employers the state of Maryland will see health-related absenteeism decline by 138,493 days per year, with a corresponding annual dollar savings of $16.9 million. The state will benefit from the health-related savings of 2,956 fewer smokers and 956 fewer alcohol abusers. The corresponding dollar savings are $8.8 million and $7.6 million per year, now and into the future (these savings include insurance premiums, co-payments and deductibles, and withholding for Medicare and Medicaid).

- *Reduced Crime*

Studies show that incarceration drops with each year of higher education. In the state of Maryland, 448 fewer individuals will be incarcerated per year, resulting in annual savings of $4.2 million (combined savings from reduced arrest, prosecution, jail, and reform costs). Reductions in victim costs (e.g., property damage, legal expenses, lost workdays, etc.) result in savings of $4.7 million per year. Finally, that people are employed rather than incarcerated adds $2.1 million of earnings per year to the economy.

- *Reduced Welfare/Unemployment*

There will be 3,504 fewer people on welfare, and 1,474 fewer drawing unemployment benefits per year, saving some $15.7 million and $13.7 million per year, respectively.

➢ **Taxpayer Return on Investment**

The return on a year's worth of state and local government investment in the Maryland's 16 community colleges is obtained by projecting the associated educational benefits into the future, discounting them back to the present, and weighing these against the $458.8 million state and local taxpayers spent during the analysis year to support the 16 colleges in the system. The analysis is based on the portion of CC operations that is wholly dependent on state and local government support. Two investment perspectives are possible, one broad and one narrow.

- *Broad Perspective*

Taxpayers expect their annual investment in the community colleges to result in higher lifetime earnings for students and social savings from lifestyle changes (reduced crime, welfare and unemployment, and improvements in health). From a broad investment perspective, the value of *all* future

earnings and associated social savings is compared to the year's worth of state and local taxpayer support that made the benefits possible. Following this procedure, the benefit/cost ratio generated for the whole system is 15.0, i.e., every dollar of state or local tax money invested in Maryland's CCs today returns a cumulative of $15 over the next 32 years.

- *Narrow Perspective*

The narrow perspective limits the benefit stream to state and local government budgets, namely increased tax collections and expenditure savings. For example, in place of total increased student earnings, the narrow perspective includes only the increased state and local tax receipts from those higher earnings. Similarly, in place of overall crime, welfare, unemployment and health savings, the narrow perspective includes only those portions that translate to actual reductions in state and local government expenditures.

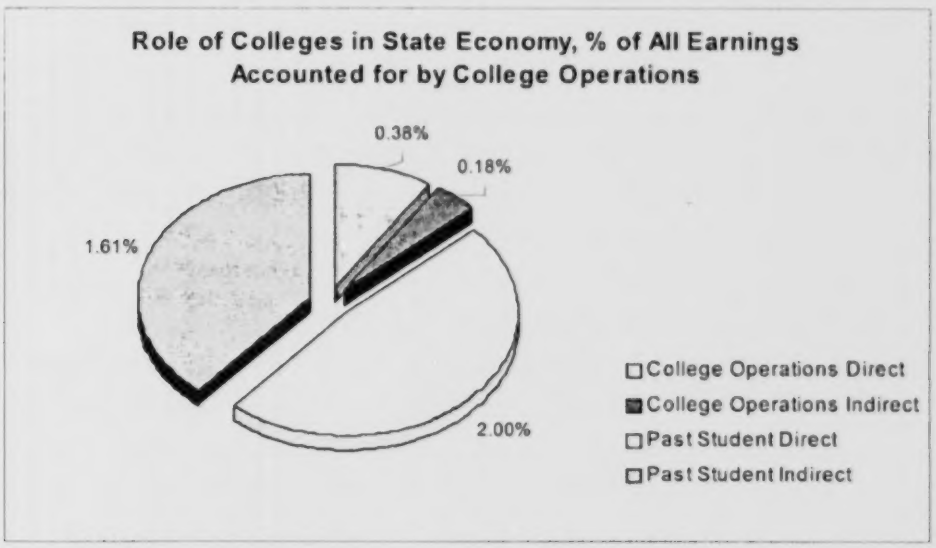
Note here that it is normal for the state government to undertake activities wanted by the public, but which are unprofitable in the marketplace. This means that positive economic returns are generally not expected from government investments. From the narrow taxpayer perspective, therefore, even a small positive return (a benefit/cost ratio equal to or just greater than 1, and/or a rate of return equal to or just greater than the 4.0% discount rate used in this analysis) would be a most favorable outcome, certainly one that justifies continued taxpayer support of the colleges. For Maryland, the narrow perspective results greatly exceed the minimum expectations. The results indicate strong and positive returns: a rate of return of 11.9%, a benefit/cost ratio of 2.1 (every dollar of state or local tax money invested today returns a cumulative $2.06 over the next 30 years), and a short payback period of only 10.2 years.

CONCLUSION

The results of this study demonstrate that the investment in the Maryland community colleges is sound from multiple perspectives. It increases the lifetime incomes of students and enriches their lives. It benefits taxpayers by generating increased tax revenues from an enlarged economy and reducing the demand for taxpayer-supported social services. Finally, it contributes to the vitality of both the local and state economies.

Benefits at a Glance

Regional Analysis			Regional Impact
Regional Economic Development			
Increment from Maryland's CCs operations			$755,438,000
Increment from past student productivity			$4,860,969,000
Total			$5,616,407,000
Job equivalent			143,220
Annual Benefits			
Higher earnings			
Aggregate (all students)			$546,435,015
Per Credit			$152
Per full-year equivalent student			$4,499
Social savings			
Aggregate (all students)			$73,717,931
Per Credit			$21
Per full-year equivalent student			$607
Investment Analysis	**RR**	**B/C Ratio**	**Payback (Years)**
Students	24.1%	5.6	5.9
Taxpayers: Broad Perspective	NA	15.0	NA
Taxpayers: Narrow Perspective	11.9%	2.1	10.2



In sum, the graph shows that the colleges account for a total of 4.2% of all earnings ($134.7 billion) generated from all sources in the economic region.

This short summary report is one of six products generated for this impact study. In addition, one long report intended for economists and CC institutional researchers (86 pp) lays out the detailed assumptions and analysis. Another report (9 pp) provides detailed tabular results by gender, ethnicity, and entry levels of education, and a one-page fact sheet contains highlights of the study results at a glance. The study also includes a one-page write-up in layman's terms about the differences between the broad and narrow taxpayer perspectives. Lastly, a PowerPoint presentation is developed showing the main results for CC Presidents to adapt and use in speeches before state legislators and other education stakeholders.

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MARYLAND'S 16 COMMUNITY COLLEGES AND THE TAXPAYER PERSPECTIVES

Maryland's 16 Community Colleges' narrow taxpayer perspective rate of return of 11.9% is considerably greater than the threshold value of 4.0%, signifying that the state government actually makes money on the investment—the colleges put more money back into the state treasury than they take out.

Maryland's 16 Community Colleges consider the return on investment from two taxpayer perspectives: broad and a narrow. The broad perspective counts all benefits regardless of recipient, while the narrow perspective counts only benefits that accrue back to state or local government in the form of book or accounting revenues. Note that the narrow perspective is the accounting stance of the private sector: revenues on one side of the books, costs on the other, and profits equaling the difference. The CCbenefits model indicates that Maryland's 16 Community Colleges are a uniquely attractive investment for state and local governments. This finding is clearly indicated from the results of the narrow taxpayer perspective investment analysis. To better appreciate this finding, we develop these two perspectives more fully below.

BROAD INVESTMENT PERSPECTIVE

The effectiveness of government programs is often expressed through the use of a benefit/cost ratio. A ratio less than one indicates that a public project is not worthwhile, whereas a project with a benefit/cost ratio greater than one is considered to be an economically sound investment. Consider some examples. A transportation authority promotes a new road or bridge by demonstrating that savings in travel time and vehicle expenses greatly exceed the project's cost. Another example: the success of a government program aimed at revitalizing a depressed economy is said to be demonstrated when the incomes created by the program greatly exceed the program cost. In still a third example, expenditures on public parks are sometimes justified by showing that the value of the recreation, including scenic and other values that accrue to park users, exceeds the public outlay for park construction, operation, and the cost of extractive resources not used. In all these cases, note that overall benefits are counted and not just those that accrue back to state or local government. This is the hallmark of the broad benefit/cost (i.e., investment) perspective.

The broad investment perspective imbedded in the CCbenefits model measures a diverse collection of community college benefits, including the increased earnings of students plus external benefits associated with savings on health care, reduced expenditures on crime (e.g., prosecution, incarceration and victim costs), reduced welfare and unemployment expenditures, and costs associated with absenteeism from work. These benefits accrue to different publics such as students, employers, victims of crime, the federal government, and state and local taxpayers. The broad perspective tallies this varied collection of benefits and measures this against the outlays of state and local government. State and local government taxpayers can view a broad perspective benefit/cost ratio greater than 1.0 as a minimal indicator of a worthwhile public investment.

NARROW INVESTMENT PERSPECTIVE

Among the benefits tracked under the broad perspective is a subset that accrues to state and local governments. A portion of higher student earnings will be captured by state and local governments in the form of added tax receipts. Additionally, because state and local governments bear part of the cost of crime, their budgets benefit from education-induced crime reductions. The same holds in varying degrees for the other assorted benefits of an educated populace. The bottom line: while state and local governments spend money in support of Maryland's 16 Community Colleges, they receive benefits in the form of increased tax receipts and an assortment of reduced expenditures or avoided social costs. The narrow investment perspective counts only benefits that could be entered into the books of state and local governments.

Worthwhile public projects routinely generate negative narrow perspective returns. Generally, the role of government is to provide services that the public wants, but the business sector finds unprofitable. Considerable funds are spent on public parks, for example, yet except for entry fees and some concessionaire or special events receipts, no moneys directly return to the state or local taxpayers. From a narrow investment perspective, taxpayer returns are negative, and the park is justified by the benefits tracked under the broad perspective.

An important finding of the CCbenefits analysis of Maryland's 16 Community Colleges is that the results are not only strong from the broad perspective but unlike most government endeavors, the taxpayer investments generate strong results from the narrow investment perspective as well. Economists generally assume a 4.0% discount rate in analyzing government projects, assuming that governments can obtain unsecured loans at a rate of 4.0%, or receive a return of 4.0% on any excess funds were they to be invested. **Since Maryland's 16 Community Colleges' narrow taxpayer perspective rate of return of 11.9% is substantially greater than 4.0%, the state government actually makes money on the investment—the colleges put more money back into the state treasury than they take out.** By funding the colleges, therefore, other beneficiaries of state funding are actually subsidized through the revenues generated by the colleges.

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FACT SHEET: ECONOMIC IMPACT OF MARYLAND'S 16 COMMUNITY COLLEGES

What role do Maryland's 16 community colleges play in the statewide economy? Business sales in the State of Maryland are $13 billion larger, and labor income is $6 billion larger due to the past and present operations of Maryland's CCs. The benefits of a robust state economy translate into job and investment opportunities, increased business revenues, greater availability of public funds, and an eased tax burden.

Maryland's CCs stimulate the state economy

• Maryland's CCs had operating expenses of $809 million in fiscal 2002, and spent $712 million (88%) of this in the State of Maryland to purchase supplies and pay salaries, wages, and benefits (i.e., earnings).

• Maryland's CCs employ 7,026 full-time and 9,193 part-time faculty and staff. Maryland's CCs paid faculty and staff salaries, wages, and benefits of $508 million in fiscal 2002.

• For every $1 Maryland's CCs pay in earnings, there is an additional $0.49 in earnings generated off-campus in the Maryland economy—this is the commonly known multiplier effect.

• The activities of Maryland's CCs encourage new business, assist existing business, and create long-term economic growth. The colleges enhance worker skills and provide customized training to local business and industry. It is estimated that the present-day Maryland workforce embodies over 62.6 million credit and non-credit hours of past and present Maryland CC training.

• Maryland's CCs' skills embodied in the present-day workforce increase the output of industries in the Maryland economy where the former students are employed by $7 billion. Associated multiplier effects (sometimes called indirect effects) in other industries increase sales by $5 billion.

• Maryland's CCs' skills from current and former students increase earnings in the State of Maryland by $3 billion directly, and by another $2 billion indirectly in fiscal 2002.

Maryland's CCs leverage taxpayer dollars

• State and local government allocated $459 million in support of Maryland's CCs in fiscal 2002. For every dollar appropriated by state and local government, Maryland's CCs' spending alone generated $1.65 in earnings in the State of Maryland.

• For every dollar appropriated by the state and local government in fiscal 2002, student earnings will increase by an average of $1.19 per year, every year through the rest of their working lives. Likewise, for every state dollar appropriated, the State of Maryland will see social savings of $0.16 per year, every year (i.e., reduced incarceration and health care expenditures, reduced expenditures on unemployment and welfare, and reduced absenteeism).

Maryland's CCs generate a return on government investment

• State and local government support for Maryland's CCs in fiscal 2002 will be fully recovered in 10.2 years, in the form of higher tax receipts (from increased student wages) and avoided costs (e.g., from reduced public expenditures on incarceration).

• Accounting for increased tax receipts and avoided costs, state and local government will see a rate of return of 11.9% on their fiscal 2002 support for Maryland's CCs.

Maryland's CCs increase individuals' earning potential

• 380,419 credit and non-credit students attended the colleges in fiscal 2002, 77% of whom were employed full or part time while attending.

• As many as 94% of the students stay in the state initially after they leave the colleges and contribute to the statewide economy. Their continued contribution is measured after accounting for out-migration, retirement, and death.

• Studies demonstrate that education increases lifetime earnings. The average annual earnings of a student with a 1-year certificate is $33,766, or 81.4% more than someone without a high school diploma or GED, and 16.1% more than a student with a high school diploma. The average earnings of someone with an Associate Degree is $39,734, or 113.5% more than someone without a high school diploma or GED, and 36.6% more than a student with a high school diploma or GED.

• After leaving college, the average Maryland's CCs student will spend 32 years in the workforce. The student who leaves with a two-year college degree will earn $344,626 more than someone with a high school diploma or GED.

• Over their next 32 years in the workforce, the average Maryland CC student's discounted lifetime earnings (i.e. future values expressed in present value terms) will increase $5.65 for every education dollar invested (in the form of tuition, fees, books, and foregone earnings from employment).

• Students enjoy an attractive 24.1% rate of return on their Maryland CC educational investment, and recover all costs (including wages foregone while attending Maryland's CCs) in 5.9 years.

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MACC Maryland Association of Community Colleges

The Socioeconomic Benefits Generated by 16 Community Colleges in Maryland

Volume 1: Main Report

June 30, 2003

M. Henry Robison and Kjell A. Christophersen

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The successful completion of this case study is largely due to excellent support from the staff of the Maryland Association of Community Colleges (MACC). They did a superb job organizing and managing the entire effort in short order. In addition, we are grateful for the work carried out by the 16 institutional research teams at the individual community colleges. Their enthusiasm for the project never wavered and their excellent questions and patience with our sometimes less-than-perfect draft report submissions challenged us to develop a better product in the end. Special thanks go to Barbara Ash of the Maryland Association of Community Colleges, who first promoted the study and made it all happen. In addition, Lucy Schneider contributed invaluable modeling and data collection expertise throughout the study period, along with our report production staff, Olivia Grauke and Annike Christophersen. Last, but by no means least, we would like to extend our thanks to Dr. Ray Taylor of the Association of Community College Trustees (ACCT) whose support through thick and thin has been steadfast. The creation of an economic modeling framework to provide low cost but rigorous economic impact analysis services for community and technical colleges was his vision, one on which he acted some two years ago. Any errors in the report are the responsibility of the authors and not of any of the above-mentioned institutions or individuals.

Dr. M. Henry Robison, Co-Principal
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CCbenefits, Inc. is a company created in collaboration with the Association of Community College Trustees (ACCT) to provide economic analysis services to community and two-year community colleges. Questions of a technical nature concerning the approach, assumptions, and/or results should be directed to CCbenefits, Inc., c/o Drs. Kjell Christophersen and Hank Robison, 1150 Alturas Dr., Suite 102, Moscow ID 83843, phone: 208-882-3567, fax: 208-882-3317, e-mail: ccbenefits@moscow.com.

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ACRONYMS

AD	Associate Degree
ABE	Adult Basic Education
ACCT	Association of Community College Trustees
B/C	Benefit/Cost Ratio
CC	Community College
CHE	Credit Hour Equivalent
ESL	English as a Second Language
GED	General Equivalency Diploma (also Education Development Certificate)
HS	High School
IO	Input-Output analysis
NCF	Net Cash Flow
NPV	Net Present Value
REIS	Regional Economic Information System
RR	Rate of Return
TC	Technical College
TD	Technical Diploma

Preface

The Association of Community College Trustees (ACCT) contracted with the authors in 1999 to create the model used in this study. The original vision was simple—to make available to colleges a generic and low cost yet comprehensive tool that would allow them to estimate the economic benefits accrued by students and taxpayers as a result of the higher education achieved. In short, it only makes economic sense for the students to attend college if their future earnings increase beyond their present investments of time and money. Likewise, taxpayers will only agree to fund colleges at the current levels or increase funding if it is demonstrated that the economic benefits gained from the education exceed the costs.

This economic impact study consists of several reports:

- The present report is the **Main Volume** for the study. It is largely intended for a limited audience (economists, institutional researchers, financial officers, etc.) interested in the overall transparency of the study, the assumptions used, the data imbedded in the model that generate the results, and the results themselves.
- The **Executive Summary** is a six-page report intended for a wide audience, written in layman's terms.
- The **Fact Sheet**, a one-page "super-executive" summary, is also intended for a wide audience where the main results are presented as bullets.
- The **Taxpayer Perspective Sheet** is a one-page layman's write-up of the differences between the "broad" and "narrow" taxpayer results.
- Finally, we submit a **PowerPoint** presentation of the main results to each college.

These reports aim to bring to the attention of all education stakeholders the economic roles played by the 16 colleges in the State of Maryland. There is something in it for the students—will they be better off attending college or should they just forego additional education and stay employed where they are? There is something in it for the taxpayers—should they continue with their investments at current levels, or is it in their economic interest to increase or decrease the funding? There is something in it for the local community—to what extent does it benefit from the daily operations of the colleges, and which sectors of the economy benefit relatively more?

Economic impact studies that provide answers to these kinds of questions are not new. In contrast to other similar studies, however, the ACCT vision was that the model reach beyond the "standard" study – the computation of the simple multiplier effects stemming from the annual operations of the colleges. Although the standard study was part and parcel of the model ultimately developed, it was only a relatively small part. The current model also accounts for the economic impacts generated by past students who are still applying their skills in the local workforce; and it accounts for a number of external social benefits such as reduced crime, improved health, and reduced welfare and unemployment, which translate into avoided costs to the taxpayers. All of these benefits are computed for each college and analyzed. The analysis is based on regional data adjusted to local situations to the greatest extent possible.

One final note of importance: although the written reports generated are similar in text to the reports prepared for other colleges, the results differ widely. **These differences, however, do not necessarily indicate that some colleges are doing a better job than others.** Differences among colleges are a reflection of the student profiles, particularly whether or not the students are able to maintain their jobs while attending, and the extent to which state and local taxpayers fund the colleges. Therefore, if the average student rate of return for College A is 15%, and that of College B is 20%, that does not mean that B is doing a better job than A. Rather, it is attributable to the employment opportunities in the region, or that one college may enroll more women than men, or more minorities, and/or different kinds of students such as transfer or workforce. In turn, the student body profiles are associated with their own distinct earnings functions reflecting these employment, gender and ethnicity differences. The location of the college, therefore, dictates the student body profile, which, to a large extent, translates into the magnitudes of the results. Thus, College A with a 15% student rate of return, may actually be a better or more efficiently managed school than College B with a 20% student rate of return. Any difference in management efficiency is not equal to the difference between the two returns.

The bottom line is simply this: do not compare the results between colleges with intent to claim that some colleges are better than others. The only legitimate comparison is between the results achieved and the threshold values for those results. In the example above, the threshold value for the rate of return is 4% (a typical discount rate applied to public investments). Since the rate of return for both College A and College B is substantially greater than 4%, then the investment is attractive relative to alternative investment opportunities in the area.

Chapter 1
INTRODUCTION

OVERVIEW

Maryland's 16 community colleges (CCs) generate a wide array of benefits. Students benefit directly from higher personal earnings, and society at large benefits indirectly from cost savings (avoided costs) associated with reduced welfare and unemployment, improved health, and reduced crime. Higher education requires a substantial investment on the parts of the student and society as a whole, however. All education stakeholders—taxpayers, legislators, employers, and students—want to know if they are getting their money's worth. In this study, Maryland's 16 Community Colleges investigate the attractiveness of the returns they generate in the state (**Table 1.1** and **Figure 1.1**) relative to alternative public investments. The benefits are presented in three ways: 1) annual benefits, 2) present values of future annual benefits (rates of return and benefit/cost ratios, etc.), and 3) statewide economic benefits, including returns to the business community.

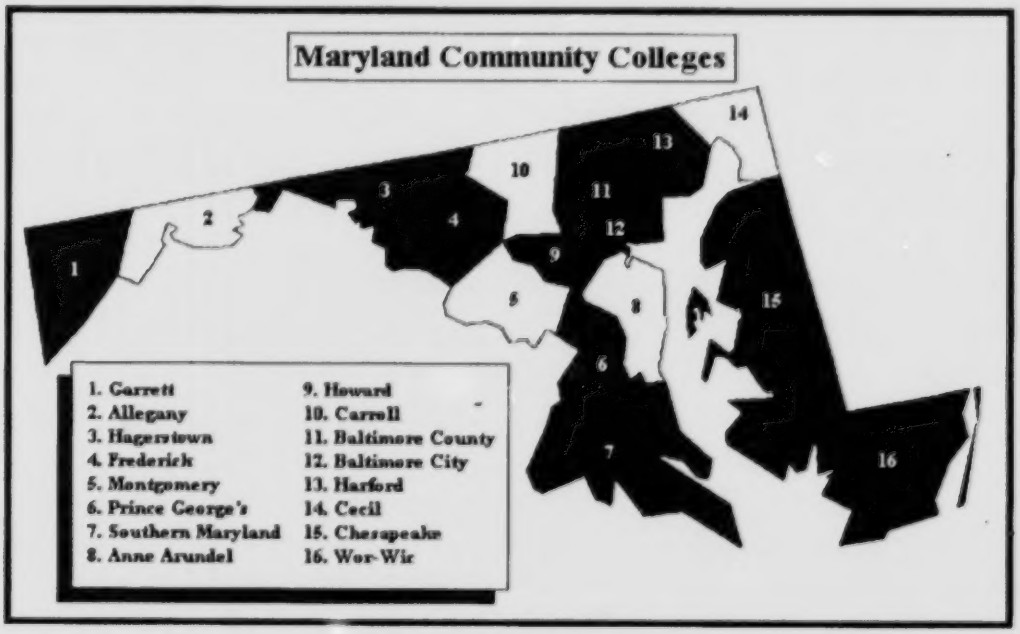
The main volume has four chapters and four appendices. **Chapter 1** is an overview of the benefits measured. **Chapter 2** details the major assumptions underlying the analysis. **Chapter 3** presents the main socioeconomic benefits, returns to business, and regional economic results. Finally, **Chapter 4** presents a sensitivity analysis of some key assumptions—tracking the changes in the results as assumptions are changed. **Appendix 1** is a glossary of terms. **Appendix 2** is a short primer on the context and meaning of the investment analysis results—the net present values (NPV), rates of return (RR), benefit/cost ratios (B/C), and the payback period. **Appendix 3** explains how the earnings related to higher education data were derived. **Appendix 4** provides a detailed technical/theoretical explanation of how benefits must be adjusted if the college can still stay open absent state and local government support.

Table 1.1. Maryland Participating CCs and '00-01 Enrollment

Name of College	Abbreviation	Credit Enrollment
Allegany College of Maryland	ACM	3,864
Anne Arundel Community College	AACC	19,154
Baltimore City Community College	BCCC	9,819
The Community College of Baltimore County	CCBC	27,892
Carroll Community College	CCC	3,747
Cecil Community College	Cecil	2,190
Chesapeake College	Chesapeake	3,140
College of Southern Maryland	CSM	9,824
Frederick Community College	FCC	6,342
Garrett College	GC	822
Hagerstown Community College	HCC	3,883
Harford Community College	HCC	7,420
Howard Community College	Howard	9,012
Montgomery College	MC	32,580
Prince George's Community College	PGCC	19,001
Wor-Wic Community College	WWCC	3,946
Total		162,636

Note: Schools appearing in grey did not participate in the study of the individual community colleges.

Figure 1.1. Geographical Distribution of Participating CCs



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ANNUAL PRIVATE AND PUBLIC BENEFITS

Private benefits are the higher earnings captured by the students; these are well known and well documented in economics literature (see for example Becker, 1964 and Mincer 1958, plus many others listed in the references at the end of this report). Less well known and documented are the indirect benefits, or what economists call *positive externalities*, which are a collection of public benefits captured by society at large, such as improved health and lifestyle habits, lower crime, and lower incidences of welfare and unemployment. These stem from savings to society as taxpayer-provided services are reduced. We estimate dollar savings (or avoided costs) from reduced arrest, prosecution, jail, and reform expenditures based on published crime statistics arranged by education levels (see **Tables 2.7** and **2.9** and the references section at the end of this report). Likewise, statistics that relate unemployment, welfare, and health habits to education levels are used to measure other savings. The annual economic impacts are presented in three ways: 1) per credit-hour equivalent (CHE), defined as a combination of credit and non-credit attendance[1], 2) per student, and 3) in the aggregate (statewide).

PRESENT VALUES OF FUTURE BENEFITS

The annual impacts continue and accrue into the future and are quantified and counted as part of the economic return of investing in education. This lifetime perspective is summarized as *present values* - a standard approach of projecting benefits into the future and discounting them back to the present. The approach allows us to express the benefits occurring incrementally (every year) in the future in present value terms so that they can be compared with the costs incurred in the present. The present value analysis determines the economic feasibility of investing in CC education—i.e., whether the benefits outweigh the costs. The time horizon over which future benefits are measured is the retirement age (65) less the average age of the students. [2]

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[1]Instruction hours are not the same as credit hours. Community colleges prepare people both for jobs and for degrees. Many attend for short periods and then leave to accept jobs without graduating. Others simply enroll in non-academic programs. Nonetheless, the CHEs earned will positively impact the students' lifetime earnings and social behavior.

[2] Retirement at age 65 is only our assumption. In some areas people retire earlier, in others later. Whether they retire at 62, 65, or 67, this will not change the magnitudes of the results by much. The assumption only affects the time horizon over which the analysis is conducted.

The present values are also expressed in four ways: 1) net present value (**NPV**) total, per CHE, and per student, 2) rate of return (**RR**) where the results are expressed as a percent return on investment, 3) benefit/cost (**B/C**) ratio – the returns per dollar expended, and 4) the payback period – the number of years needed to fully recover the investments made (see **Appendices 1** and **2** for a more detailed explanation of the meaning of these terms).

Statewide Economic and Business Community Benefits

The benefits of a robust economy are many: jobs, increased business revenues, greater availability of public investment funds, and eased tax burdens. The financial and educational activities of the 16 community colleges in Maryland benefit state businesses directly by raising the skill level of the state labor force and providing opportunities for direct contract training of employees. State businesses benefit as well as the presence of a trained labor force works to attract new industry and increase the efficiency, competitiveness, and output of existing industry. All these together spell a more effective and robust state economy.

In this study we show the impact of Maryland's 16 community colleges as a creator of earnings in the state economy. Increased earnings are displayed by industrial sector (for the purposes of this report, we employ the major divisions of the Standard Industrial Classification – SIC – which includes all industrial and service sectors). The role that Maryland's CCs play in the state economy is then indicated by the percentage of sector-by-sector earnings explained by the colleges. The geographic boundaries of the regional economy used in this report are shown in **Figure 1.1.** In general, these CC-linked earnings fall under two categories: 1) earnings generated by the annual operating expenditures of the colleges; and 2) earnings attributable to the CC skills embodied in the workforce.

Chapter 2
DATA SOURCES AND ASSUMPTIONS

INTRODUCTION

To the extent possible, documented statistics were used to estimate model parameters. In the few cases where hard data were scarce, however, the college institutional researchers on the scene applied well-informed judgments and estimations on the basis of their intimate knowledge of their college and student body.

This chapter contains six assumption sections, all based on various data imbedded in the analytic model: 1) the aggregate profiles of the 16 community colleges; 2) annual earnings by education levels; 3) the social benefit assumptions (health, crime, and welfare/unemployment); 4) education costs; 5) other assumptions (the discount rate used, health, crime, and welfare cost statistics, etc.); and 6) assumptions pertaining to statewide economic effects.

PROFILE

Faculty, Staff, and Operating Budgets

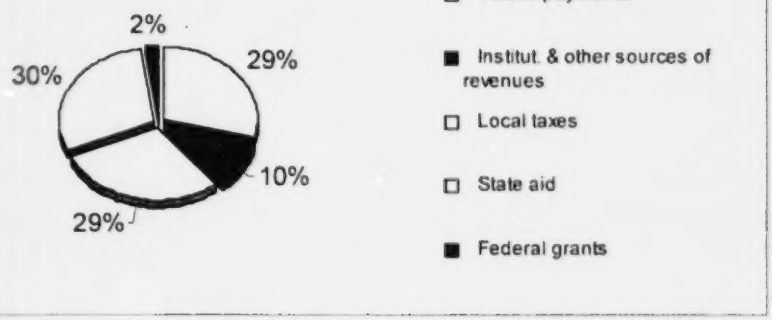
The Maryland community colleges employed 7,026 full- and 9,193 part-time faculty and staff in fiscal year 2002 amounting to a total annual payroll of some $507.7 million.[3] **Table 2.1** shows the aggregate annual revenues by funding source: a total of $780.7 million. Two main revenue sources—private and public—are indicated. Private sources include tuition and fees (29.3%) plus 9.8% from other private sources (such as contract revenues, interest payments and the like). Public funding is comprised of local taxes (29.1%), state aid (29.6%), and federal grants (2.1%). These budget data are critical in identifying the annual costs of educating the CC student body from the perspectives of the students and the taxpayers alike. The same information is displayed in **Figure 2.1** in the form of a pie chart.

[3] Faculty counts are from the Employee Data System (EDS) file, which is a point-in-time snapshot of all fall semester employment. These values exclude work study, student aid, and seasonal/temporary workers.

Table 2.1. Aggregate Revenues

Sources	Revenues	Total	% of Total
Private Funding			
Tuition payments	$228,585,681		29.3%
Institut. & other sources of revenues	$76,602,641	$305,188,322	9.8%
Public Funding			
Local taxes	$227,405,146		29.1%
State aid	$231,426,328		29.6%
Federal grants	$16,694,595	$475,526,069	2.1%
Total		$780,714,391	100%

Figure 2.1. Revenues



The Students

Students attend community colleges for different reasons: to prepare for transfer to four-year institutions, to obtain Associate Degrees or Certificates in professional/technical programs, to obtain basic skills, or perhaps to take refresher courses in non-credit programs—workforce students, for example. Students also leave for various reasons -- they may have achieved their educational goals or decided to interrupt their college career to work full time. **Tables 2.2 - 2.4** summarize the student body profiles for the 16 community colleges in the State of Maryland. The unduplicated student body (headcount) is 380,419 (fiscal 2002 enrollment).

Some students forego earnings entirely while attending college while others may hold full- or part-time jobs. Information about student employment plays a role in determining the *opportunity cost* of education incurred by the students while attending

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the Maryland community college system.[4] **Table 2.2** rows labeled "% of students employed while attending college" and "% of full-time earning potential" provide the percentage estimates of the students who held jobs (77%) while attending college, and how much they earned (74%) relative to full-time employment (or what they would statistically be earning if they did not attend college). The former is a simple percent estimate of the portion of the student body working full or part time. The latter is a more complex estimate of their earnings relative to their earning power if they did not attend college (i.e., recognizing that several students may hold one or more part-time jobs paying minimum wage while attending college).

Table 2.2. Student Body Profile

	Values
Total headcount of unduplicated credit students	162,636
Total headcount of unduplicated non-credit students	217,783
Total unduplicated enrollment, all campuses	380,419
% of students employed while attending college	77%
% of full-time earning potential	74%
Students remaining in state after leaving college	94%
Thirty-year attrition rate (leaving state)	17%
"Settling In" factors (years):	
Completing Associate Degree	2.0
Completing Certificate	0.5
Non-completing transfer track	2.5
Non-completing workforce	0.0
ABE/ESL/GED	0.5

As indicated in the table, it is estimated that 94% of the students remain in the state (as defined in **Figure 1.1**) and thereby generate statewide benefits. The remaining 6% leave the state altogether and are not counted as part of the economic development benefits. The 94% retention rate applies only to the first year, however. We assume that 17% of the students, and thus associated benefits, will leave the state over the next 30 years due to attrition (e.g., retirement, out-migration, or death).

The last five items in **Table 2.2** are *settling-in* factors—the time needed by students to settle into the careers that will characterize their working lives. These factors are adapted from Norton Grubb (June 1999). Settling-in factors have the effect of delaying the onset of the benefits to the students and to society at large.

[4] The opportunity cost is the measure of the earnings foregone, i.e., the earnings the individual would have collected had he or she been working instead of attending any of the 16 Maryland community colleges.

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Entry-Level Education, Gender, and Ethnicity

Table 2.3 and **Figure 2.2** show the education level, gender, and ethnicity of the aggregate student body. This breakdown is used only to add precision to the analysis, not for purposes of comparing between different groups.[5] Five education entry levels are indicated in approximate one-year increments, ranging from less than HS to post AD. These provide the platform upon which the economic benefits are computed.

The *entry level* characterizes the education level of the students when they first enter the colleges; this is consistent with the way most colleges keep their records. The analysis in this report, however, is based on the educational achievements of the students during the current year. As not all students reported in the enrollment figures for the fiscal year are in their first year of college, an adjustment was made to account for students who had accumulated credits during their community college experience and moved up from the "HS/GED equivalent" category. For this reason, the education levels of the student body must also be estimated for the beginning of the analysis year. Thus, of the 46,940 white males who first entered with a high school diploma or GED, it is estimated that only 11,818 still remain in that category at the beginning of the analysis year, meaning that 35,123 students have actually moved up from the "HS/GED equivalent" category to the "One year post HS or less" category or beyond since they first entered the colleges.[6] (Note that the "Entry Level" and "Begin Year" columns always add to the same total.) Differences between the two columns reflect a redistribution of students from entry level to where they are at the beginning of the analysis year. The assumptions underlying the process of redistributing the students from the "Entry Level" to "Begin Year" columns are internal to the economic model – they are designed to capture the dynamics of the educational progress as the students move up the educational ladder beyond their entry level.

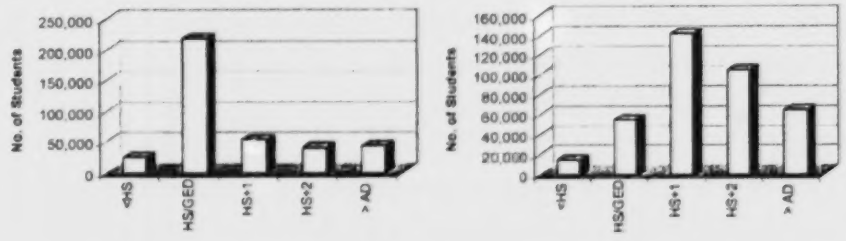
[5] In this volume we present the gender and ethnicity breakdown only in **Table 2.3**. Otherwise, the breakdown is presented as weighted averages for the remainder of the report. However, the separate companion volume – **Volume 2: Detailed Results** – does show the breakdown by gender and ethnicity and level of education.

[6] These calculations are internal to the model, based on parameters (such as the frequency of "stopouts") that characterize how typical CC students progress over time in their college career from when they first started up to the analysis year.

Table 2.3. Student Body Education Level: Entry vs. Beginning of Analysis Year

	White Male		Minority Male		White Female		Minority Female		Total	
Education Level	Entry Level	Begin Year	Entry Level	Begin Year	Entry Level	Begin Year	Entry Level	Begin Year	Entry Level	Begin Year
< HS/GED	5,823	3,397	4,503	2,627	8,772	5,118	5,641	3,291	24,739	14,432
HS/GED equivalent	46,940	11,818	33,105	8,423	74,770	18,712	63,719	15,536	218,534	54,488
One year post HS or less	13,805	31,231	5,856	20,636	21,168	49,711	12,461	39,807	53,290	141,385
Two years post HS or less	10,007	24,835	4,214	13,483	17,088	39,637	9,116	27,104	40,425	105,059
> AD	10,272	15,567	4,594	7,103	19,453	28,075	9,112	14,311	43,431	65,055
Total	86,847	86,847	52,271	52,271	141,252	141,252	100,049	100,049	380,419	380,419

Figure 2.2. Student Body Education Level: Entry vs. Beginning of Analysis Year



The Achievements

Table 2.4, along with **Figures 2.3** and **2.4**, shows the student breakdown in terms of analysis year academic pursuits and/or achievements according to six categories: 1) retirees plus those attending (non-reimbursable) hobby and recreation courses, 2) Associate Degree completers, 3) Diploma and Certificate completers, 4) all transfer students, 5) all workforce students, and 6) ABE/ESL/GED students.[7]

As indicated in the table, students achieving their graduation goals would be those completing Associate Degrees or Certificates (2.8% and 0.9%, respectively). The majority of students complete college credits, and either fulfill their educational needs, or return the following year to continue to work toward their goals (27.3% + 59.5% = 86.8% in the transfer track and workforce categories, respectively). The retired and leisure students (1.4%) and ABE/ESL/GED students (8.1%) complete the breakdown of the student body. The retired students are simply backed out of the analysis altogether on the assumption that they do not attend the community colleges to acquire skills that will increase their earnings. ABE/ESL/GED students are assumed to have a lower

[7] ABE/ESL/GED = Adult Basic Education, English as a Second Language, and General Equivalency Diploma

percentage impact than other students, because the end product of their education is to arrive at the "starting gate" on an equal basis with others. This does not mean that ABE/ESL/GED education has lower value; it simply means that these students must complete an extra step before they can compete effectively in the job market and reap the benefits of higher earnings.

The fourth column shows the average age of the students generating the benefits (excluding retirees). The time horizon for the analysis is 37.4 years, which is the difference between the average age (32.6 years) and retirement age (65 years).

As indicated in Column 5, the average Associate Degree and Certificate student completed 17.9 and 14.0 CHEs of study, respectively, during the analysis year. The total number of CHEs completed during the year of analysis for the entire system student body is 3.6 million. Finally, the last column shows the average time the students are actually in attendance during the analysis year. This information is needed to determine the opportunity cost of their education (or the time they would otherwise have been working and earning wages).

Table 2.4. Levels of Achievement

Student Body	Student Distribution	Headcount Credit and Non-Credit	Avg. Age	CHEs This Year	Total CHEs	# Years Attend.
Retired and court-required students	1.4%	5,461	70	6.9	37,560	0.23
Completing AD	2.8%	10,572	29	17.9	188,859	0.60
Completing Certificate	0.9%	3,350	33	14.0	46,734	0.47
Transfer track	27.3%	103,826	26	16.1	1,669,762	0.54
Workforce and all other non-credit students	59.5%	226,474	36	6.3	1,426,225	0.21
ABE/ESL/GED	8.1%	30,737	32	8.5	260,071	0.28
Total or weighted averages	100.0%	380,419	32.6	9.6	3,629,211	
Credits required for one full-time year equivalent of study					30	

Note: weighted average of CHEs per year does not include the retired students

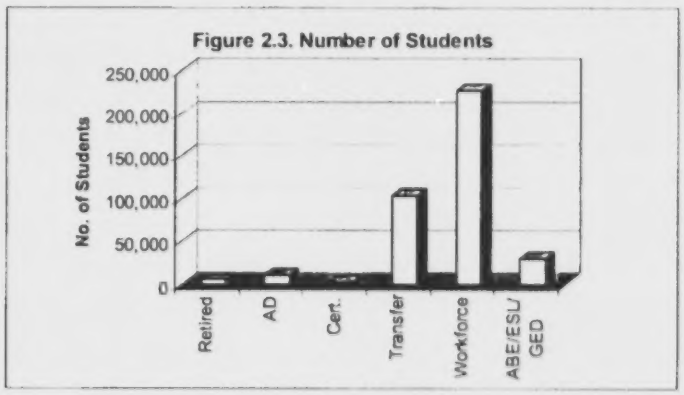


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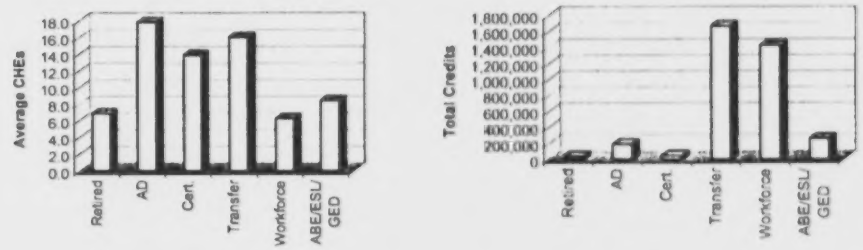
Figure 2.4. Average and Total CHEs Earned During the Analysis Year



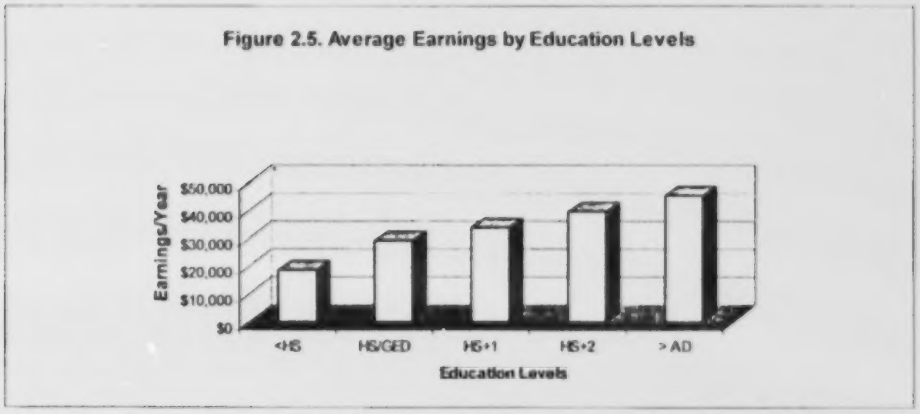
ANNUAL PRIVATE BENEFITS

The earnings statistics in **Table 2.5** and **Figure 2.5,** on which the benefit estimates (reported in **Chapter 3**) are based, reflect all occupations (technical and non-technical). The lower the education level, the lower the average earnings, regardless of the subject matters studied. The distinguishing feature among the achievement categories, therefore, is the number of CHEs completed. Statistics indicate that earnings are highly correlated with education, but correlation does not necessarily mean causation. Higher education is not the only factor explaining the private and public benefits reported in the statistics. Other variables such as ability, family background, and socioeconomic status play significant roles. The *simple correlation* between higher earnings and education nonetheless defines the *upper limit* of the effect measured. Our estimates of higher education's impact on earnings are based on a survey of recent econometric studies. A literature review by Chris Molitor and Duane Leigh (March, 2001) indicates that the upper limit benefits defined by correlation should be discounted by 10%. Absent any similar research for the social variables (health, crime, and welfare and unemployment), we assume that the same discounting factor applies as well to the public benefits.

As education milestones are achieved, students move into higher levels of average earnings. **Table 2.5** shows average earnings by one-year education increments, linked to the gender and ethnicity profile of Maryland's CCs' student body. The differences between the steps are indicated in the last column. We also assume that *all* education has value, and thereby attribute value to students completing less than full steps as well. Specific detail on **Table 2.5** data sources and estimating procedures is found in **Appendix 3.**

Table 2.5. Weighted Average Earnings

Entry Level	Average Earnings	Difference
One year short of HS/GED	$18,611	NA
HS/GED equivalent	$29,084	$10,473
One-year Certificate	$33,766	$4,681
Two-year Associate Degree	$39,734	$5,968
One year post Associate Degree	$45,267	$5,533



ANNUAL PUBLIC BENEFITS

Both students and society at large benefit from higher earnings. Indeed, the principal motivation for publicly funded higher education is to raise the productivity of the workforce and the incomes that the students will enjoy once they complete their studies. Society benefits in other ways as well. Higher education is associated with a variety of lifestyle changes that generate savings (e.g., reduced welfare and unemployment, improved health, and reduced crime). Note that these are *external* or *incidental* benefits of education (see box). Colleges are created to provide education, not to reduce crime, welfare and unemployment, or improve health. The fact that these incidental benefits occur and can be measured, however, is a bonus that enhances the economic attractiveness of the college operations. It should not be taken to mean that taxpayers should channel more money to colleges on the strength of these external benefits. Our purpose is simply to bring to the attention of education stakeholders that the activities of the 16 colleges in the Maryland system impact society in many more ways than simply the education they provide. In so doing, we have identified and measured some social

benefits obviously related to educational achievements and included them in the mix of impacts generated by the colleges.

Assuming state and local taxpayers represent the public, the public benefits of higher education can be gauged from two perspectives, 1) a *broad* perspective that tallies all benefits, and 2) a *narrow* perspective that considers only changes in the revenues and expenditures of state and local government.

The Beekeeper Analogy

The classic example of a positive externality (sometimes called "neighborhood effect") in economics is that of the private beekeeper. The beekeeper's only intention is to make money by selling honey. Like any other business, the beekeeper's receipts must at least cover his operating costs. If they don't, he will shut down.

But from society's standpoint there is more. Flower blossoms provide the raw input bees need for honey production, and smart beekeepers locate near flowering sources such as orchards. Nearby orchard owners, in turn, benefit as the bees spread the pollen necessary for orchard growth and fruit production. This is an uncompensated external benefit of beekeeping, and economists have long recognized that society might actually do well to subsidize positive externalities such as beekeeping.

Community Colleges are in some ways like the beekeepers. Strictly speaking, their business is in providing education and raising people's incomes. Along the way, however, external benefits are created. Students' health and lifestyles are improved, and society indirectly benefits from these just as orchard owners indirectly benefit from the location of beekeepers. Aiming at an optimal expenditure of public funds, the CCbenefits model tracks and accounts for many of these external benefits, and compares them to the public cost (what the taxpayers agree to pay) of CC education.

Higher Earnings

Broad Perspective: Higher education begets higher earnings. The economy generates more income than it would without the CC skills embodied in the labor force. From the broad taxpayer perspective, the total increase in earnings is counted as benefits of CC education, adjusted down by the alternative education variable in **Table 2.9** (22.2%)—these students would still be able to attend college elsewhere even if the CCs in the state were not present.

Narrow Perspective: Higher earnings translate into higher state and local *tax collections*. In the narrow taxpayer perspective we assume that the state and local authorities will collect 13.9% of the higher earnings in the form of taxes—the estimated composite of all taxes other than the federal income taxes.[8]

[8] The tax data are obtained from the U.S. Census Bureau. See also **Appendix 2**.

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Health Savings

The improved health of students generates savings in three measurable ways: 1) lower absenteeism from work, 2) reduced smoking, and 3) reduced alcohol abuse (**Table 2.6**; see also **Figures 2.6-2.8**). These variables are based on softer (i.e., less-documented) data. In general, statistics show a positive correlation between higher education and improved health habits. **Table 2.6** shows the calculated reductions in the incidences of smoking and alcohol abuse as a function of adding the higher education, also linked to the gender and ethnicity profiles of the aggregate student body. Recall from above, the health savings are reduced by 10% in recognition of causation variables not yet identified.

Broad Perspective: The benefits from reduced absenteeism are equal to the average earnings per day multiplied by the number of days saved (less the students covered by the alternative education variable, as above). These are benefits that accrue largely to employers. Smoking and alcohol-related savings accrue mostly to the individuals who will *not* have to incur the health-related costs. In the broad taxpayer perspective, however, these benefits accrued to employers and individuals are also public benefits.

Narrow Perspective: Taxpayers benefit from reduced absenteeism to the extent that the state and local government is an employer. Accordingly, we assume a taxpayer's portion of absenteeism savings at 11.2%, equal to the estimated public portion of employment in the state.[9] As for smoking and alcohol-related savings, the taxpayers benefit to the extent that state and local health subsidies (to hospitals, for example) are reduced. We assume that 6% of the total benefits can be counted as taxpayer savings.

[9] The ratio of state and local earnings over total earnings in the US (Regional Economic Information System – REIS, Bureau of Economic Analysis, Dept. of Commerce, 1998).

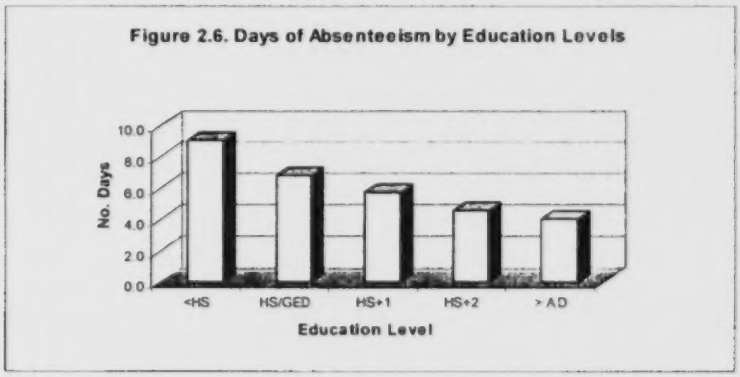
Table 2.6. Reduced Absenteeism, Smoking, and Alcohol Habits

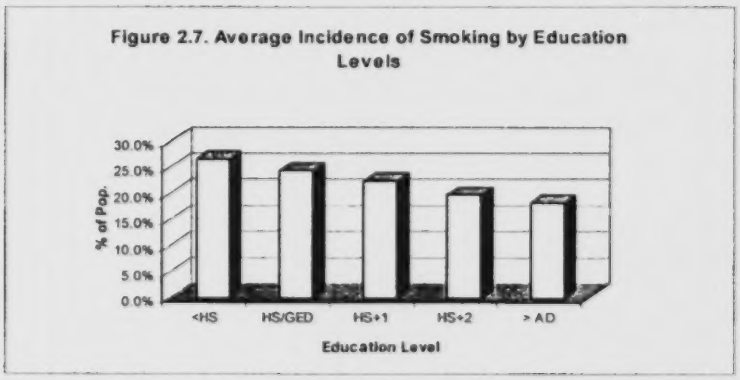
	Absenteeism		Smoking		Alcohol Abuse	
Education Level	Days	%/Year	Average	Reduction	Average	Reduction
< HS/GED	9.1	3.5%	26.5%	NA	8.4%	NA
HS/GED equivalent	6.8	2.6%	24.3%	8.4%	7.7%	8.2%
One year post HS or less	5.8	2.2%	22.4%	8.0%	7.1%	8.0%
Two years post HS or less	4.6	1.8%	19.6%	12.3%	6.2%	12.4%
> AD	4.0	1.6%	18.1%	7.7%	5.7%	7.9%

1. Absenteeism: U.S. Department of Labor, Bureau of Labor Statistics, Division of Labor Force Statistics, http://www.bls.gov

2. Smoking: a) National Center for Health Statistics. *Health, United States, 2001*, Table 61. Centers for Disease Control and Prevention, 2001. b) US Department of Treasury. *The Economic Costs of Smoking in the United States and the Benefits of Comprehensive Tobacco Legislation*. Report-3113, March 1998. http://www.treas.gov/press/releases/report3113.htm.

3. Alcoholism: a) National Center for Health Statistics. "Health Promotion and Disease Questionnaire of the 1990 National Health Interview Survey." b) National Institute on Drug Abuse (NIDA). *The Economic Costs of Alcohol and Drug Abuse in the United States – 1992*, 1992.





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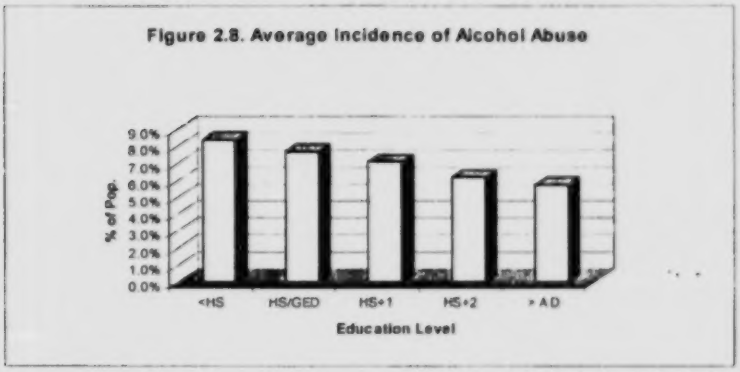


Crime Reduction Benefits

Table 2.7 and **Figure 2.9** relate the probabilities of incarceration to education levels—incarceration drops on a sliding scale as education levels rise (linked to the gender and ethnicity profile of the Maryland's CCs student body).[10] The implication is, as people achieve higher education levels, they are statistically less likely to commit crimes. The correlation difference between before and after the education achievement (multiplied by the average cost per year) comprises the upper limit of the benefits attributable to education.

We identify three types of crime-related expenses: 1) the expense of incarceration, including prosecution, imprisonment, and reform, 2) victim costs, and 3) productivity lost as a result of time spent in jail or prison rather than working. As with our other social statistics, crime-related expenses are reduced by 10% in recognition of other causation factors.

Broad Perspective: From the broad taxpayer perspective, all reductions in crime-related expenses are counted as a benefit (less the students covered by the alternative education variable, as above).

Narrow Perspective: We assume that nearly all (80%) of the incarceration savings accrue to the state and local taxpayers—federal funding covers the remainder. Crime victim savings are avoided costs to the potential victims, not to the taxpayers. As such, we claim none of these as taxpayer savings. Finally, we apply our "composite" state and local government average tax rate (13.9%) to the added productivity of persons *not* incarcerated to arrive at the taxpayer benefits.

[10] See also Beck and Harrison: http://www.ojp.usdoj.gov/bjs/abstract/p00.htm.

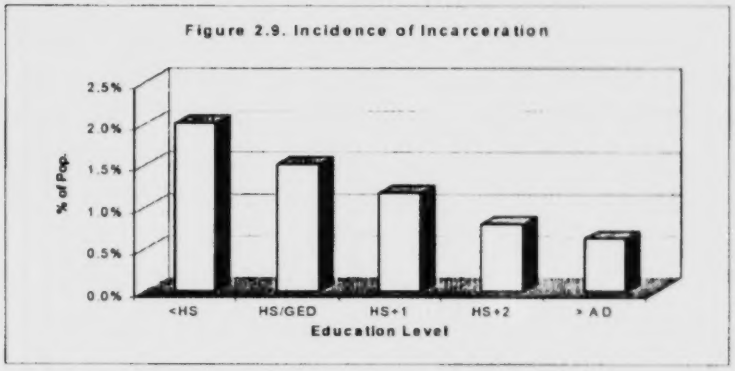
Table 2.7. Incarceration Rates

Education Level	Average	Reduction
< HS/GED	2.0%	NA
HS/GED equivalent	1.5%	24.6%
One year post HS or less	1.2%	22.2%
Two years post HS or less	0.8%	32.2%
> AD	0.6%	21.0%

1. Haigler, Karl, et al. *Literacy Behind Prison Walls*. National Center for Education Statistics. NCES 94102, December 1994.

2. Bonczar, T. P. and Alan J. Beck; *Lifetime Likelihood of Going to State or Federal Prison*, US Department of Justice, Office of Justice Programs, March 1997.

3. Bureau of Justice Statistics. Criminal Justice Expenditure and Employment Extracts Program (CJEE), December 2000 http://www.ojp.usdoj.gov/bjs/eande.htm#selected



Welfare and Unemployment Reduction Benefits

Higher education is statistically associated with lower welfare and unemployment. **Table 2.8** and **Figure 2.10** relate the probabilities of individuals applying for welfare and/or unemployment assistance to education levels (linked to the gender and ethnicity profiles of the student bodies). As above, all welfare and unemployment savings are reduced by 10% in recognition of other causation factors.

Broad Perspective: Reduced welfare and unemployment claims multiplied by the average cost per year are counted in full as benefits in the broad taxpayer perspective (less the students covered by the alternative education variable, as above).

Narrow Perspective: Taxpayer benefits from reduced welfare are limited to 16% – the extent to which the state and local taxpayers subsidize the welfare system. None is claimed for unemployment, because none of these costs are borne by the state taxpayers.

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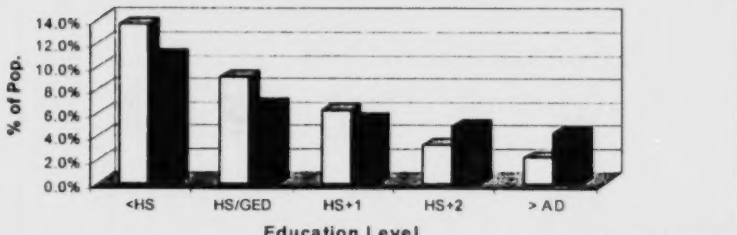
Table 2.8. Welfare and Unemployment

	Welfare		Unemployment	
Education Level	Average	Reduction	Average	Reduction
< HS/GED	13.7%	NA	10.9%	NA
HS/GED equivalent	9.1%	33.5%	6.7%	38.5%
One year post HS or less	6.2%	31.4%	5.4%	19.3%
Two years post HS or less	3.3%	46.6%	4.8%	10.6%
> AD	2.2%	33.5%	4.3%	11.4%

1. Temporary Assistance for Needy Families (TANF). *Third Annual Report to Congress*, Table 10:12. US Department of Health and Human Services, August 2000.

2. Rector, Robert (Testimony). *Means-Tested Welfare Spending: Past and Future Growth*. Heritage Foundation, March 07, 2001.

Figure 2.10. Welfare and Unemployment



COSTS

There are two main cost components considered in the analytic framework: 1) the cost incurred by the student, including expenses for tuition and books, and the opportunity cost of his or her time (represented by the earnings foregone while attending college), and 2) the cost incurred by state and local government taxpayers, which is part of the colleges' operating and capital costs (the budget—see **Table 2.1**). These are briefly discussed below.

Opportunity Cost of Time

The opportunity cost of time is, by far, the largest cost. While attending college, most students forego some earnings, because they are not employed or are employed only part time. Some may even go into debt. The assumptions are discussed in conjunction with **Table 2.2** above. For the non-working students, the opportunity cost is the full

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measure of the incomes not earned during their CC attendance. For students working part time, the opportunity cost is the difference between what they could make full time less what they are making part time plus the estimated dollar value of the leisure time given up. For students working full time, the only opportunity cost of time charged is for the value of the leisure time given up. [11] The opportunity costs are derived from the earnings categories by education entry levels given in **Table 2.5**, although with some important modifications, as briefly described below:

- The earnings in **Table 2.5** are averages based on trajectories of earnings for all ages, from 17 to 65 (roughly defining the time spent engaged in the workforce).

- The average earnings, therefore, define the midpoint of a working life trajectory that begins with low entry-level wages and culminates with a typical worker's highest wages around age 60. [12] The earnings data shown in **Table 2.5** are specific to the State of Maryland, weighted, however, to reflect the specific gender and ethnicity makeup of the aggregate student body. Details on earnings and education sources are found in **Appendix 3**.

- The opportunity cost of time is then conditioned by the average age of the student (32.6 years, see **Table 2.4**). In particular, the average earnings at the midpoint ($34,421 in **Table 3.5**) are adjusted downward to $27,240 to reflect the average earnings at age 32.6.

The Budget

Beyond the student perspective, our assessment of Maryland's community colleges considers the benefits and costs from the state and local government taxpayer perspective. Accordingly, only the state and local government revenues in **Table 2.1** are included as costs in the investment and benefit/cost assessment. All else equal, the larger the other revenue sources in **Table 2.1** (federal grants, student tuition, and

[11] Elementary consumer theory presents a tradeoff between income and leisure (e.g., Henderson and Quandt, 1958). Students able to work full or part time while attending college maintain all or part of their incomes, but give up a significant amount of their leisure time. Failing to impute value to the leisure foregone would underestimate the cost of attending college.

[12] This profile of lifetime earnings is well documented in labor economics literature, see for example, Willis (1986), supported by the well-respected theoretical and empirical work of Becker (1964) and Mincer (1958).

contract revenues) relative to state and local government revenues, the larger will be the relative economic payback to the taxpayers.

Other Assumptions

Table 2.9 lists several other assumptions imbedded in the analytic model: 1) the discount rate and time horizon, 2) crime-related costs (incarceration costs that are inclusive of the cost per prison year plus all costs associated with arrest, investigation, trial and finally incarceration), 3) welfare and unemployment costs per year,[13] and 4) health-related costs. [14] The alternative education opportunity assumption is discussed later in this chapter in association with the statewide economic impacts.

Table 2.9. Miscellaneous Variables

	Variables
Discount rate	4.0%
Time horizon, years to retirement	32.4
Average cost per prison year (arrest, trial, incarceration, rehab. etc.)	$77,178
Average length of incarceration (total years)	4.0
Average victim cost	$ 85,000
Average cost per welfare year	$ 75,138
Average duration on welfare (total years)	4.0
Average cost per unemployment year	$ 36,249
Average duration on unemployment (total years)	4.0
Smoking-related medical costs per year	$ 2,962
Alcohol-related medical costs per year	$ 7,946
Alternative education opportunities	22.2%

Assumptions adapted from:

1. Bureau of Justice Statistics. Table .05 : "Total direct and intergovernmental expenditure, by activity and level of government, fiscal years 1980-97." Criminal Justice Expenditure and Employment Extracts Program (CJEE), December 2000.
2. Office of International Criminal Justice (OICJ). "The Extent and Costs of Victimization, Crime and Justice." *The Americas*, Dec-Jan 1995.
3. Rector, Robert (Testimony). *Means-Tested Welfare Spending: Past and Future Growth*. Heritage Foundation, March 07, 2001.
4. U.S. Department of Labor. Bureau of Labor Statistics, http://www.bls.gov/news.release/annpay.t01.htm.
5. US Department of Treasury. *The Economic Costs of Smoking in the United States and the Benefits of Comprehensive Tobacco Legislation*. Report-3113, March 1998.
6. National Institute on Drug Abuse (NIDA). *The Economic Costs of Alcohol and Drug Abuse in the United States – 1992*, 1992.

[13] As indicated in the table, we assume that the average duration on welfare and unemployment is 4.0 and 4.0 years, respectively. This means that, over the next 30 years or so, the cumulative incidence of welfare and/or unemployment will be spread evenly over the time horizon—it is not a consecutive period.
[14] The incarceration, health, welfare and unemployment probability, and cost variables are internal to the analytic model.

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STATEWIDE ECONOMIC BENEFITS

In general, the statewide economy is affected by the presence of the 16 community colleges in Maryland in two ways: from their day-to-day operations (including capital spending), and from students who enter the workforce with increased skills. Day-to-day operations of the colleges provide the *direct* jobs and earnings of the faculty and staff, and additional *indirect* jobs and earnings through the action of regional multiplier effects. At the same time, the presence of college-trained past and present students in the state workforce deepens the economy's stock of human capital, which attracts new industry and makes existing industry more productive.

Estimating these statewide economic effects requires a number of interrelated models. Multiplier effects are obtained with an input-output (IO) model constructed for Maryland.[15] Estimating CC operations effects requires an additional model that takes CC expenditures, deducts spending that leaks from the economy, and bridges what is left to the sectors of the IO model.

Estimating the skill-enhancing effect of past students on the statewide economy entails five basic steps:

1. Estimate the number of past students still active in the statewide workforce.
2. Adjust for alternative education opportunities.
3. Estimate the increased earnings of the students still active in the statewide workforce.
4. Adjust the overall earnings estimated in step 3 to account for a collection of substitution effects. This provides an estimate of the direct increase in statewide earnings.
5. Allocate the direct increase in statewide earnings to affected economic sectors, and augment these to account for a collection of demand- and supply-side multiplier effects.

[15] The economic impact model for the 16 community colleges in Maryland is constructed using EMSI input-output modeling software, and data purchased from Economic Modeling Specialists, Inc. (EMSI). EMSI data is used for constructing input-output models.

The end results include estimates of the impact of past student skills and increased productivity on: 1) the size of state industries, and 2) the size of the overall statewide economy.

This section is divided into a number of subsections. The first documents our estimation of day-to-day college operations effects followed by sections that detail the steps necessary to estimate the effect of past-student skills on the statewide economy.

The Impact of Maryland's CCs' Operations

The first step in estimating the impact of the 16 Maryland CCs' operations is to assemble data on their combined operating and capital expenditures. These data are assembled from college budgets and collected into the categories of **Table 2.10**. Column 1 simply shows the total dollar amount of spending. Columns 2 through 5 apportion that spending to in-state and out-of-state vendors. The net state portion is derived in Column 6.

The information on total spending required for Column 1 is generally readily available, though sorting specific items to the categories of the table can take some time. Information in Columns 2 through 5 is generally more problematic: hard data are scarce on the local/non-local split. In these cases, the staff members of the 16 Maryland community colleges were asked to use their best judgment.

The first row in **Table 2.10** shows salaries, wages, and benefits. These *direct* earnings are part of the state's overall earnings by place-of-work. These appear later as "Direct Earnings of Faculty and Staff" in the table of findings, **Table 3.16**. Dollar values in **Table 2.10**, Column 6, "Net In-State Spending," are fed into the economic region IO model.[16] The IO model provides an estimate of indirect effects, and these appear as "Indirect Earnings" in **Table 3.16**.

[16] **Table 2.10**, by itself, might provide useful information to local audiences—Chambers of Commerce, local business establishments, Rotary clubs, and the like. The table indicates that the colleges are "good neighbors" in the state community, evidenced by the fact that an estimated 88% of all college expenditures benefit state vendors ($711,944 / $809,217 = 88%).

Table 2.10. Profile of College Spending In and Out of State Economy ($ Thousands)

Spending Categories	Total Dollar Amount (1)	In-State % (2)	Out of State % (3)	In-State % (4)	Out of State % (5)	Net In-State Spending (6)
Salaries, Wages, and Benefits	$507,694	95%	5%			$480,553
Travel	$8,726	64%	36%			$5,545
Electricity and Natural Gas	$11,522	77%	23%			$8,926
Telephone	$4,563	75%	25%			$3,435
Building Materials and Gardening Supplies	$2,835	90%	10%	56%	44%	$2,545
General Merchandise Stores	$65,886	63%	37%	32%	68%	$41,195
Eating and Drinking	$878	87%	13%			$764
Maintenance and Repair Construction	$7,960	96%	4%			$7,632
New Construction	$66,558	85%	15%			$56,827
Insurance	$14,216	88%	12%			$12,527
Legal Services	$889	95%	5%			$842
Credit Agencies	$1,281	79%	21%			$1,009
U.S. Postal Service	$3,605	74%	26%			$2,660
Accounting, Auditing, and Bookkeeping	$556	92%	8%			$510
Marketing	$5,001	86%	14%			$4,309
Other Business Services	$57,286	74%	20%			$42,208
Water Supply and Sewerage systems	$594	96%	4%			$570
Printing and Publishing	$7,476	85%	15%			$6,373
Rental Property	$4,172	98%	2%			$4,092
Services to Buildings	$7,773	94%	6%			$7,308
Unemployment Compensation	$391	100%	0%			$391
Honoraria and Other Payments to Households	$29,354	74%	26%			$21,724
Total	$809,217					$711,944

Note: this table provides details for the summary of the college role in the state economy (Table 3.16)

Estimating CHEs Embodied in the Present-Day Workforce

This section describes the submodel for estimating the CHEs of past instruction embodied in the present-day statewide workforce from the 16 community colleges in Maryland. **Table 2.11** indicates variables critical to the model, while **Table 2.12** shows the various steps in the calculation. The various values appearing in **Table 2.11** originally appear in **Table 2.2** and **Table 2.4**. Considering **Table 2.12** one column at a time reveals the steps involved in estimating embodied CHEs.

Column 1 provides an estimate of the enrollment history (unduplicated headcount) of the students enrolled in the 16 Maryland community colleges. Column 2 represents the non-retired students, in other words, the students who have the potential to go into the workforce. Column 3 is the same as Column 2, but net of students who leave the state immediately upon leaving college. As shown in the table, 94% of the students remain in the state upon leaving the community colleges, and 6% leave the state.

Column 4 goes one step further—a comparison of Columns 3 and 4 indicates that all past students have left college except for the last three years (1999-2002) where students are still enrolled (the leaver assumptions are shown in Column 9).

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Column 5 further reduces leavers to focus only on those who have settled into a somewhat permanent occupation. As shown in Column 10 (the "settling factor"), it is assumed that all students settle into permanent occupations by their fourth year out of school. Settling-in assumptions are specified in **Table 2.2** above.

Column 6 transitions further from leavers who have settled into jobs to leavers still active in the current workforce. Here we net off workers who, subsequent to leaving college and settling into the state workforce, have out-migrated, retired, or died. As shown in **Table 2.11**, 17% of the past students will out-migrate, retire or die over the course of the next 30 years. This "30-year attrition" follows an assumed logarithmic decay function shown in Column 11 labeled "active in state workforce."

Column 7 shows the average CHEs generated per year back to 1973. These data were obtained by dividing total year-by-year CHEs by the corresponding headcount.[17] Column 8 shows the product of the year-by-year average CHEs, and the estimate of the number of past students active in the current workforce in Column 6. Looking to the total in Column 8, we estimate that the current Maryland workforce embodies some 62.6 million CHEs of past instruction from the 16 community colleges.

Table 2.11. Critical Variables

Assumptions	Values
Current headcount of students	380,419
Students remaining in state after leaving CCs	94%
Thirty-year attrition	17%
Decay rate	0.6%
Overall average of credits earned per student this year	9.6

Reducing the CHEs to Account for Alternative Education Opportunities

The 62.6 million CHEs of past instruction from Maryland's 16 community colleges indicated in **Table 2.12** increase the skills embodied in the statewide workforce and, through them, the overall size of the state economy in terms of earnings. Before turning to the income calculation, however, it is fair to ask to what degree past students would have been able to obtain schooling (and therefore skills) absent the community college system in Maryland. This is the common "with and without condition" in applied economic analysis.

[17] We used the current year estimate of CHEs (see **Table 2.4**), adjusted for the retired students, as a proxy for the average achievement per student in all prior years before FY 2002.

The institutional research staffs provided the estimate of the alternative education opportunity variable (22.2%) by taking into account opportunities such as private trade schools and colleges, public four-year institutions, correspondence schools, and so on. Accordingly, when calculating the net increase in regional income attributable to Maryland's CCs, the historic CHEs indicated in **Table 2.12** are reduced by 22.2%.

Table 2.12. Estimating Credit Hours of Instruction Embodied in the Workforce

									Assumptions		
	Student Enrollment Headcount	Subtract Retired Students	Subtract Students Migrating Immediately	Students Who Have Left College (Leavers)	Leavers Who Have Settled Into Jobs	# Settled into Jobs - Active in the Workforce	Average Credit Equivalents	Credits Embodied in the Workforce	% of Students in Workforce	"Settling" Factor	Active in Workforce
Year	1	2	3	4	5	6	7	8	9	10	11
1973	158,094	155,824	146,750	146,750	146,750	121,567	9.58	1,164,465	100%	100%	82.8%
1974	165,339	162,966	153,476	153,476	153,476	127,939	9.58	1,225,501	100%	100%	83.4%
1975	176,184	173,655	163,543	163,543	163,543	137,189	9.58	1,314,105	100%	100%	83.9%
1976	183,579	180,944	170,407	170,407	170,407	143,847	9.58	1,377,883	100%	100%	84.4%
1977	191,177	188,432	177,460	177,460	177,460	150,743	9.58	1,443,941	100%	100%	84.9%
1978	198,430	195,581	184,193	184,193	184,193	157,447	9.58	1,508,159	100%	100%	85.5%
1979	205,306	202,358	190,575	190,575	190,575	163,928	9.58	1,570,241	100%	100%	86.0%
1980	213,277	210,215	197,974	197,974	197,974	171,365	9.58	1,641,475	100%	100%	86.6%
1981	221,309	218,132	205,430	205,430	205,430	178,938	9.58	1,714,018	100%	100%	87.1%
1982	228,659	225,376	212,252	212,252	212,252	186,045	9.58	1,782,088	100%	100%	87.7%
1983	237,841	234,426	220,776	220,776	220,776	194,734	9.58	1,865,321	100%	100%	88.2%
1984	245,968	242,437	228,320	228,320	228,320	202,656	9.58	1,941,203	100%	100%	88.8%
1985	249,490	245,909	231,589	231,589	231,589	206,852	9.58	1,981,398	100%	100%	89.3%
1986	256,686	253,001	238,269	238,269	238,269	214,158	9.58	2,051,379	100%	100%	89.9%
1987	263,675	259,890	244,756	244,756	244,756	221,374	9.58	2,120,498	100%	100%	90.4%
1988	273,252	269,329	253,646	253,646	253,646	230,858	9.58	2,211,349	100%	100%	91.0%
1989	284,766	280,678	264,334	264,334	264,334	242,101	9.58	2,319,038	100%	100%	91.6%
1990	296,360	292,105	275,096	275,096	275,096	253,544	9.58	2,428,650	100%	100%	92.2%
1991	300,305	295,994	278,758	278,758	278,758	258,537	9.58	2,476,476	100%	100%	92.7%
1992	304,925	300,547	283,046	283,046	283,046	264,166	9.58	2,530,401	100%	100%	93.3%
1993	312,704	308,214	290,267	290,267	290,267	272,611	9.58	2,611,288	100%	100%	93.9%
1994	314,132	309,622	291,593	291,593	291,593	275,580	9.58	2,639,731	100%	100%	94.5%
1995	321,608	316,991	298,533	298,533	298,533	283,915	9.58	2,719,570	100%	100%	95.1%
1996	321,735	317,116	298,650	298,650	298,650	285,814	9.58	2,737,765	100%	100%	95.7%
1997	324,287	319,631	301,019	301,019	301,019	289,895	9.58	2,776,855	100%	100%	96.3%
1998	346,795	341,816	321,912	321,912	321,912	311,968	9.58	2,988,288	100%	100%	96.9%
1999	341,152	336,254	316,674	316,674	316,674	308,823	9.58	2,958,163	100%	100%	97.5%
2000	350,223	345,195	325,094	324,930	292,437	286,982	9.58	2,748,953	100%	90%	98.1%
2001	365,946	360,693	339,689	332,046	249,035	245,929	9.58	2,355,706	98%	75%	98.8%
2002	380,419	374,958	353,124	300,155	150,078	150,078	9.58	1,437,566	85%	50%	100.0%
Embodied Total								62,641,472			

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From Embodied CHEs to Direct Statewide Income Effects

In the standard model, statewide income is expressed as a function of physical and human capital. Human capital is increased by adding new workers or by enhancing the skills of existing workers – the former adds the productivity of the new workers; the latter increases the productivity of existing workers. Increased human capital has a direct and indirect effect on *statewide income*. The direct effect is conveyed in the higher earnings of the newly skilled workers themselves, while the indirect stems from associated multiplier effects. This section describes our process for estimating the direct effect.

A key part of the overall model is the "engine" that estimates the value per CHE of instruction.[18] The product of per-CHE added earnings, and the total of embodied past CC instruction from the 16 Maryland community colleges (62.6 million CHEs, **Table 2.12**) provides the dollar estimate of how much more past students are earning as a result of their CC coursework. The question is: how much of this added *personal* income can be counted as added *statewide* income?

The answer to this question depends on the magnitude of certain elasticity assumptions at work in the statewide income model. As shown in the text box, the elasticities can vary from perfectly inelastic to perfectly elastic. The text box describes the issue according to "two polar cases," one accepting all of the added student income, the other accepting none of it. Obviously the actual value will lie somewhere between. How much of increased past student income should be counted as increased regional income?

[18] Briefly, the engine that estimates the value per CHE does so by combining earnings/education data from **Table 2.5** with information on aggregate student achievements during the analysis year (from **Table 2.4**). These calculations are discussed more fully in **Chapter 3**.

There is considerable empirical literature on the economic development effects of education, though mainly in the international rather than regional context. In a recent study, Bils and Klenow (2000) survey previous work on the subject and advance a model of their own. Based on their findings, we reduce the full past student income increase (the perfectly inelastic case) by 2/3 to arrive at our estimate of the net increase in statewide income. This estimate for Maryland's CCs appears in **Table 3.16** under the heading "Earnings Attributable to Past Student Economic Development Effects," "Direct Earnings."

Elasticity of Substitution: Two Polar Cases

Polar Case 1, Two Inelastic Assumptions.

Assumption #1: *The rate of technical substitution between local skilled and unskilled workers is infinitely inelastic.* Skilled workers are able to perform tasks that unskilled workers cannot. Here, the added skills only increase value; they do not replace or substitute for existing production inputs. The added skills enable product line expansion and increased competitiveness of existing industry, and they attract new industry. Earnings and output expand as a result.

Assumption #2: *The rate of technical substitution between local and non-local workers is infinitely inelastic.* Skilled workers cannot be attracted from outside the state. Here, the existence of state skilled workers enables industry to do things they could not do otherwise. Locally skilled workers may attract new industry to the state (there is a near stand-alone development theory based on the notion that skilled workers attract new industry – Borts and Stein, 1964).

Polar Case 2, Two Elastic Assumptions.

Assumption #1: *The rate of technical substitution between local skilled and unskilled workers is infinitely elastic.* This implies that skilled workers are substituted for unskilled workers in a manner that creates no net additional regional earnings. Businesses simply replace lower productivity (and lower paid) unskilled workers with some smaller number of higher productivity (and higher paid) skilled workers, with no net change in overall output or earnings.

Assumption #2: *The rate of technical substitution between local and non-local workers is infinitely elastic.* Here existing or new industry can draw skilled workers from outside the state without extraordinary inducements or wage premiums that would otherwise increase costs and reduce competitiveness. Statewide growth is driven by something other than local workforce skills. Hamilton et al., 1991, provides a broad discussion of the issues that work to limit the response of statewide income to specified economic changes.

The Industries where Past Students Work

Calculating the indirect impacts of workforce-embodied CC skills also requires the use of the statewide IO model discussed above. The model captures the extent to which a dollar spent turns over in the economy. We estimate indirect income effects by applying the IO multiplier to the direct effects. The use of IO multipliers in this way requires that the direct effects be disaggregated into

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specific industrial sectors. Disaggregating direct impacts avoids IO aggregation error,[19] and it facilitates an analysis of the 16 Maryland CCs' contribution to the business sector – an analysis that appears in **Chapter 3**.

Table 2.13 provides information on the sectoral distribution of jobs in the statewide economy. The table provides a draft-stage vehicle for collecting information from the 16 Maryland community colleges on the sectoral breakdown of their past students, and it documents the information provided by the colleges. **Table 2.13** appears with four columns briefly described below.

Column 1 appears for reference and simply shows by sector the current distribution of *all jobs* in the state economy. For example, 1.6% of all statewide jobs are in the Agriculture and Agricultural services sector, 8.7% of all jobs are in the Finance, Insurance, and Real Estate sector, and so on. Column 2 shows the distribution by sector of *past students*, i.e., an estimate of the industries where they currently work. For example, while 1.6% of all statewide jobs are in the Agriculture and Agricultural services sector, only 0.1% of past students are estimated to be in that sector. In contrast, while 8.7% of all jobs are in the Finance, Insurance, and Real Estate sector, 16.4% of past students are estimated to be in that sector.

There is a long-standing theory of regional development known as *stage theory*. The notion is that regional economies develop by progressing from "low stage industries" (agriculture, mining, logging, etc.), to "higher stage industries" (process manufacturing, fabricative manufacturing), and finally to specialized finance, engineering, and so on. The distribution of past students shown in column 2 is derived mechanically, on the assumption that past students tend to find jobs in the higher development stage industries.[20]

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[19] Aggregation error occurs when a model with many industrial sectors is reduced through industry combination to a model with many fewer "aggregated industries" (see Miller and Blair, 1985, Chapter 5). Our initial estimate of past-student direct earnings effects appears with no industry detail, and would thus require aggregating all industries to a single aggregate. By any measure, use of such an aggregated multiplier would court an unacceptable aggregation error. At the same time, the EMSI IO modeling system conveys industry detail at roughly the SIC 4-digit level. An assembly of data on direct past student effects at this fine level of detail is not realistic. Our solution is to disaggregate past student direct effects to the nineteen sectors appearing in **Table 2.13**.

[20] Parr (1999) describes four stages of economic development: primary production, process manufacturing, fabricative manufacturing, and producer services and capital export. We apply a "development score" to Parr's stages: low scores for lower stage sectors and higher scores for higher

In the course of assembling the data for our analysis, the 16 Maryland community colleges have examined the distribution of past students as indicated in Column 2, and made any adjustments needed to accurately reflect the current realities. The revised distribution appears in Column 3. In the case where Columns 2 and 3 show the same percentages, the research staffs at the colleges have concluded that no changes to the mechanical estimates appearing in Column 2 were needed.

Column 4 applies the distribution of student percentages in Column 3 to the total historic CHEs embodied in the workforce. This latter total is obtained from **Table 2.12**, and reappears at the bottom of Column 4 as the total. In **Chapter 3**, we estimate the contribution to student earnings per CHE of CC instruction. This product provides our estimate of the direct effect of past CC operations on regional earnings by industry.

The Indirect Economic Development Effects of Students

The previous section described how we estimated the increment of statewide earnings directly attributable to the CC skills embodied in the current region workforce. Next, we turn to the indirect effects on both the demand- and supply-sides.

First, consider demand-side effects. Statewide earnings are larger because of the skills embodied in past CC students still active in the workforce. As earnings increase, so do industry outputs and industry purchases of inputs.[21] These in turn generate subsequent rounds of increased earnings, which are measured with the familiar multiplier effects. These indirect effects on the demand-side are estimated in the statewide IO model by converting the embodied CHEs shown in **Table 2.13** into direct increased industry sales.

Second, consider the supply-side indirect effect. Economic development theory describes a process of "cumulative causation," or "agglomeration," whereby growth becomes in some degree self-perpetuating. The location of a new industry (A) in the state attracts other industries (B, C, and D) that use industry A's outputs as inputs. This,

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development sectors. The scores are applied to employment in each sector, then normalized to form weights for distributing past students. The end result is that past students favor higher stage industries. For additional detail on the use of this approach for classifying industries by industrial stage, see Rutgers et al, 2002.

[21] For example, associated with the increased output and earnings is an increased demand for both consumer goods and services, and goods and services purchased by businesses as inputs. These in turn produce a set of statewide economic multiplier effects. These are all captured and included as part of the demand-side indirect effects.

in turn, produces subsequent rounds of industry growth, and so on.[22] To estimate agglomeration effects, we configure our economic region IO model to provide a set of so-called supply-driven multipliers (see for example Miller and Blair, 1985). We estimate the supply-side effects by converting the embodied CHEs shown in **Table 2.13** into direct increased industry value added, and then apply these to the multipliers of the supply-driven statewide IO model.[23]

Table 2.13. Estimating the Distribution of Past Students by Industrial Sectors of the Regional Economy

Industries	Distribution of All Jobs 1	Provisional Distribution of Past Students 2	Final Distribution of Past Students 3	Distribution of Historic CHEs Embodied in Current Workforce 4
Agriculture and Agricultural Services	1.6%	0.1%	0.1%	92,886
Mining, Sand, and Gravel	0.1%	0.0%	0.0%	4,583
Construction	6.9%	0.6%	0.6%	406,597
Manufacturing: Food, Wood, Paper, and Textiles	1.7%	0.8%	0.8%	514,251
Manufacturing: Chemicals, Petroleum, Stone, and Glass	2.5%	2.3%	2.3%	1,468,021
Manufacturing: Computer and Electronic Equipment	0.3%	0.7%	0.7%	408,067
Manufacturing: Other	0.9%	0.9%	0.9%	542,456
Transportation	2.2%	1.0%	1.0%	636,940
Public Utilities	0.4%	0.2%	0.2%	110,207
Publishing and Communications	1.9%	3.5%	3.5%	2,195,527
Trade	20.2%	19.1%	19.1%	11,981,200
Finance, Insurance, and Real Estate	8.7%	16.4%	16.4%	10,271,838
Motels, Eating/Drinking, and Amusement/Recreation	7.5%	3.5%	3.5%	2,216,486
Consumer Services	6.9%	3.3%	3.3%	2,052,877
Business Services	10.0%	9.4%	9.4%	5,901,501
Medical/Educational/Social services	12.4%	23.5%	23.5%	14,716,935
Federal Government	6.2%	5.9%	5.9%	3,675,750
State and Local Government	9.7%	8.7%	8.7%	5,445,351
Total	100%	100%	100%	62,641,472

[22] For a more complete discussion of agglomeration and cumulative causation see Krugman (1999).
[23] Agglomeration effects are difficult to estimate. Our procedure assumes that so-called "supply-driven IO multiplier effects" capture the agglomeration effects. To increase the plausibility of this assumption, we apply only the direct effects associated with the industries in the highest stages of development.

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Chapter 3
PRIVATE, PUBLIC, AND STATEWIDE ECONOMIC BENEFITS

INTRODUCTION

This chapter summarizes the main study results in four sections: 1) the aggregate annual private and public benefits; 2) these same benefits measured per CHE and per student; 3) future benefits expressed in terms of net present value, rate of return, and benefit/cost ratio, and 4) the statewide economic benefits.

ANNUAL BENEFITS

Higher Student Earnings

The annual benefits are summarized in **Tables 3.1** and **3.2** (see also **Figure 3.1**). We begin with earnings growth in **Table 3.1**. Last year, each student completed, on average, 9.6 CHEs at the 16 Maryland community colleges (see **Table 2.4**), only a fraction of one full year of study. This is because the majority of students attend for a variety of purposes as discussed in conjunction with **Table 2.4**: for some, to make progress towards an eventual degree, and for others, to acquire certain skills that will increase their productivity in the workforce. A total of 380,419 students will capture $546.4 million worth of higher annual earnings based on this average increase in educational attainment.

Social Savings

Health-Related Savings

Also in **Table 3.1**, we see that improved health, lower welfare and unemployment, and lower crime will result in annual dollar savings to the taxpayers of $33.3 million, $29.4 million, and $11.0 million (rounded). In **Table 3.2**, these same results are presented in greater detail—health-related absenteeism will decline by 138,493 days per year, translating to a total of 533 years' worth of productivity gained per year (based on 260 workdays per year). Annual total dollar savings from reduced absenteeism days equals $16.9 million. There will be 2,956 fewer smokers and 956 fewer alcohol abusers,

amounting to annual total dollar savings of $8.8 and $7.6 million, respectively, inclusive of insurance premiums, personal payments, and withholding for Medicare and Medicaid.

Crime-Related Savings

There will be an estimated 448 fewer people incarcerated as a result of the higher education obtained, saving the taxpayers a total of about $4.2 million per year. The assumptions pertaining to these results are listed in **Table 2.9** in the previous chapter. They are based on an average duration of 4.0 years incarcerated at an average cost of $77,178 per year (inclusive of arrest, prosecution, incarceration, and rehabilitation). Fewer people incarcerated means more people gainfully employed – this translates to $2.1 million in additional annual earnings for the state. Victim costs will be reduced by $4.7 million per year.

Welfare and Unemployment Savings

There will be 3,504 and 1,474 fewer people on welfare and unemployment, respectively, in the community. The corresponding total dollar savings for the state community amounts to $29.4 million ($15.7 million for welfare + $13.7 million for unemployment savings) for one year, assuming that the average time spent on welfare and unemployment is 4.0 years (see **Table 2.9**) spread over a thirty-year period.

Total Public Benefits

All told, there will be $73.7 million in public savings per year in the community – the sum of all health, crime, and welfare/unemployment benefits in **Table 3.2.**

Table 3.1 Student Body Achievements, Higher Earnings, and Social Benefits

		Social (External Benefits)			
Level of Education	Higher Earnings	Improved Health	Lower Welfare Unemployment	Lower Crime	Total
< HS/GED	$19,258,248	$1,004,028	$2,066,547	$490,106	$22,818,929
HS/GED equivalent	$24,372,903	$720,688	$1,583,612	$322,905	$27,000,108
One year post HS or less	$205,965,023	$16,832,729	$16,923,201	$6,302,801	$246,023,754
Two years post HS or less	$200,514,241	$10,052,322	$6,188,167	$2,905,526	$219,660,256
> Associate Degree	$96,324,599	$4,680,077	$2,626,466	$1,018,756	$104,649,898
Total	$546,435,015	$33,289,844	$29,387,992	$11,040,094	$620,152,946

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Figure 3.1. Higher Earnings and Social Savings per Year

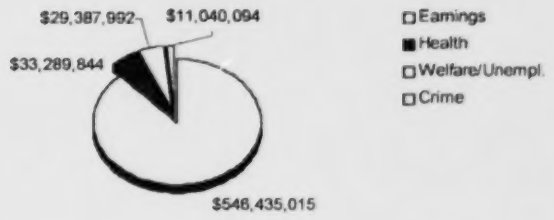


Table 3.2. Summary of Annual Benefits

	Units	Earnings	Social Savings
Higher earnings	NA	$546,435,015	
Health benefits			
Absenteeism savings (days)	138,493	NA	$16,934,990
Fewer smokers, medical savings (# persons)	2,956	NA	$8,756,435
Fewer alcohol abusers (# persons)	956	NA	$7,598,419
Crime benefits			
Incarceration savings (# persons)	448	NA	$4,235,976
Crime victim savings	NA	NA	$4,665,293
Added productivity (fewer incarcerated)	NA	NA	$2,138,825
Welfare/unemployment benefits			
Welfare savings (# persons)	3,504	NA	$15,701,602
Unemployment savings (# persons)	1,474	NA	$13,686,390
Total		$546,435,015	$73,717,931

ANNUAL BENEFITS PER CHE AND PER STUDENT

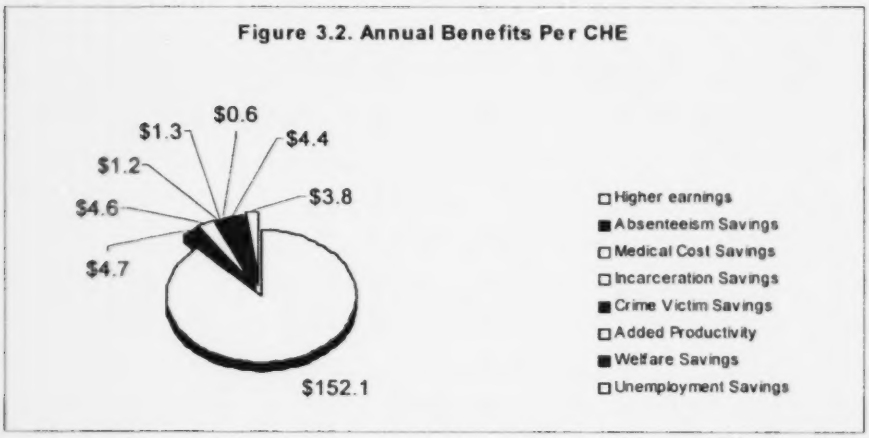
The aggregate benefits reported in **Tables 3.1** and **3.2** above are expressed per CHE and per student in **Table 3.3**. These are also displayed in the form of a pie chart in **Figure 3.2**. On average, students capture: 1) $152 per year in higher earnings per CHE,[24] and 2) $1,436 per year in higher earnings per student on the basis of the number of CHEs completed. **Converted to a full-year equivalent (30 CHEs), the annual earnings would amount to $4,499 per student**. On average, the social benefits per CHE range from a low of $1 for Added Productivity to a high of $5 per CHE for Absenteeism Savings. On a per

[24] Thus, a student attending for 10 CHEs will add $1,521 per year to the lifetime earnings. A longer curriculum will add substantially more. The earnings expectations are portrayed as linear but with many computational steps involved (see **Chapter 2**). The extrapolation is based on the averages of low earnings additions for leavers completing few CHEs, plus higher additions for leavers completing more CHEs.

student basis, they range from a low of $6 per student for Added Productivity to a high of $45 for Absenteeism Savings. On a full-year equivalent basis (30 CHEs), the social savings would amount to $607 per student (the total of $5,106 less $4,499 of higher private earnings as indicated in **Table 3.3**).[25]

Table 3.3. Annual Benefits Per CHE and Per Student

	Per Credit	Per Student	Annualized
Higher earnings	$152	$1,436	$4,499
Absenteeism Savings	$5	$45	$139
Medical Cost Savings	$5	$43	$135
Incarceration Savings	$1	$11	$35
Crime Victim Savings	$1	$12	$38
Added Productivity	$1	$6	$18
Welfare Savings	$4	$41	$129
Unemployment Savings	$4	$36	$113
Total	$173	$1,630	$5,106



THE INVESTMENT ANALYSIS: INCORPORATING FUTURE BENEFITS

The results in **Tables 3.1** and **3.2** provide only a single-year snapshot of the benefits. As long as the students remain in the workforce, however, the CC-acquired skills continue to add productivity over time. In the investment analysis, the higher earnings and avoided costs are projected into the future over the working life of the student, discounted to the present, and then compared to the present costs of education. The

[25] The values in **Table 3.3** and **Figure 3.2** are calculated based on the various statistical sources referenced in **Table 2.9**, in conjunction with the student profile and headcount numbers provided by the college.

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investment is feasible if all discounted future benefits are greater than or equal to the costs.[26]

The investment analysis results are shown in **Table 3.10** (in the aggregate, per CHE, and per student). The end results sought are the Net Present Value (**NPV**), Rate of Return (**RR**), the Benefit/Cost (**B/C**) ratio and the Payback Period.[27] These are simply different ways of expressing the results. All of the present value results shown are intermediary steps that *ultimately generate* the net present values, rates of return, and benefit/cost ratios.

We begin with some definitions in **Table 3.4. Private** benefits are the higher earnings captured by the students themselves. **Broad taxpayer benefits** are the additions to earnings plus lower overall expenditures related to health, crime, welfare, and unemployment. **Narrow taxpayer benefits** include increased state and local tax revenues (from increased incomes), and savings from reduced state and local government expenditures for incarceration, health, and welfare.

Table 3.4. Some Definitions

Terms	Definitions
Student (Private) Benefits	Higher earnings captured by the students
Taxpayer Benefits: Broad	Additions to earnings plus lower overall expenditures related to health, crime, welfare, and unemployment
Taxpayer Benefits: Narrow	Increased state and local government tax collections plus lower government expenditures related to health, crime, welfare, and unemployment
Student Costs	Tuition (**Table 2.1**) plus the opportunity cost of time
Taxpayer Costs	Taxes (state and local, see **Table 2.1**)
Results:	
Student Perspective	Student Benefits / Student Costs
Taxpayer Perspective: Broad	Taxpayer Benefits (Broad) / Taxpayer Costs
Taxpayer Perspective: Narrow	Taxpayer Benefits (Narrow) / Taxpayer Costs

[26] Future benefits are worth less than present benefits. The present value of $5,000 to be received 30 years from today is worth only $1,603 given a 4% discount rate ($5,000/ $(1.04)^{30}$ = $1,603). If the same benefits occur each year for thirty years, each year's benefit must be discounted to the present, summed and collapsed into one value that represents the *cumulative* present value of all future benefits. Thus, the present value of 30-years' worth of $5,000 per year is $90,000.

[27] The criteria for feasibility: 1) the net present value must be positive or equal to zero; 2) the rate of return must be equal to or greater than the returns from other similar risk investments; 3) the benefit/cost ratio must be equal to or greater than 1; and 4) the payback period is the number of years of benefits required to fully recover the investment made.

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On the cost side, student costs consist of the tuition paid by the students (29.3% of the total in **Table 2.1**) and, most importantly, the opportunity cost of time (the earnings foregone). Also included here are the other sources of institutional revenues from private sources (9.8%). The taxpayer costs consist of the state and local tax items in **Table 2.1**, or a total of 58.8%.

The opportunity cost (earnings foregone) incurred by the student body in the aggregate is estimated in **Table 3.5**. The first number in the table is the overall average statistical annual income of the student body (given gender and ethnicity characteristics). This number, however, reflects the midpoint of the lifetime trajectory of earnings, while what *is* needed is the earnings of the students while enrolled (which is expected to be less than earnings at the midpoint). This is the second number in the table, or $27,240 per year, assuming full-time employment. The adjustment from the first to the second number takes into account the average age of the student body and the relationship between earnings and age as specified by the well-known and tested "Mincer equation" (see, for example, Willis, 1986).

We then deduct the retired student body (1.4%) to arrive at the net number of students subject to opportunity cost calculations— 374,958 students. The 87,075 not working are charged the full opportunity cost of time (based on the average term in attendance), or $757.3 million. The 287,883 working students are charged only a fraction of the full opportunity cost, or $639.4 million as indicated in the table. Finally, we adjust the opportunity cost downward by the Pell and other student aid grants and the estimated 63% adjustment for the restricted use of these grants for tuition and fees.

Table 3.5 Opportunity Costs (Earnings Foregone), $ per Year

				Opp. Cost
Average statistical annual income of given gender and ethnicity profile			$34,421	
Annual income, given gender and ethnicity profile, at current age of students			$27,240	
CHEs per student (net of retired)		9.6		
% of full year in attendance and earnings foregone while attending		32%	$8,697	
Total number of students			380,419	
Less retired students, %		1.4%	5,461	
Remaining students subject to opportunity cost computation			374,958	
Students not working while attending college and opportunity cost		23%	87,075	$757,331,200
Number of working students			287,883	
Earnings relative to statistical averages (%) and opportunity cost		74%	$2,221	$639,400,711
Working students % and number		77%	287,883	
Value of Leisure time (at 1/3 working time)	20%		$1,739	
Value of Leisure time forgone				$500,769,204
Total opportunity cost				$1,897,501,116
Pell and other student aid			$68,583,306	
Restricted portion of student aid (tuition and fees)		63%	$43,213,657	($25,369,649)
GRAND TOTAL STUDENT OPPORTUNITY COST				$1,872,131,467

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We also present the results in different ways. First, the student perspective results indicate whether the education obtained at the Maryland community colleges pays by comparing the private benefits (higher earnings) to the private costs. Second (as discussed in the previous chapter), we compare *all* private and public benefits to the public costs (the state and local taxpayer contributions in **Table 2.1**) in a **broad taxpayer perspective** in present value terms. Third and finally, in a **narrow taxpayer perspective**, we compare only a portion of the public benefits (taxpayer actual savings) to the public costs; i.e., do state and local taxpayer investments of $458.8 million (**Table 2.1**) pay off in terms of the public savings generated?

The Student Perspective

The collective investment of the students (time and money) is assessed in **Table 3.6.** Column 1 tracks the increased earnings of the student body as they leave the colleges, and follows them over the course of their assumed working lives (65 - 32.6 = 32 years, see **Table 2.4**). The upward trend in earnings mimics the Mincer equation (see Willis, 1986). It reflects both the growth in students' earnings over time and the spread in the increased earnings attributable to education.[28] Column 2 is simply Column 1 reduced by the 10% discount value that accounts for causation factors affecting student earnings. Column 3 shows the cost of the single year's education. Finally, Column 4 looks at the educational investment from a cash flow perspective, subtracting annual costs from the annual benefits.

[28] We computed a Mincer equation based on the estimated coefficients presented in Willis, 1986, p. 545. These were adjusted to current year dollars in the usual fashion by applying the "GDP Implicit Price Deflator."

Table 3.6. Student Earnings ($ Thousands)

Year	1 Higher Earnings Gross	2 Higher Earnings Net	3 Cost	4 Net Cash Flow
1	$258,994	$233,095	$2,168,846	($1,935,751)
2	$291,644	$262,479	$0	$262,479
3	$432,535	$389,281	$0	$389,281
4	$466,156	$419,541	$0	$419,541
5	$500,655	$450,590	$0	$450,590
6	$535,889	$482,300	$0	$482,300
7	$571,703	$514,532	$0	$514,532
8	$607,928	$547,135	$0	$547,135
9	$644,384	$579,945	$0	$579,945
10	$680,881	$612,793	$0	$612,793
11	$717,219	$645,497	$0	$645,497
12	$753,193	$677,874	$0	$677,874
13	$788,592	$709,732	$0	$709,732
14	$823,200	$740,880	$0	$740,880
15	$856,803	$771,122	$0	$771,122
16	$889,186	$800,268	$0	$800,268
17	$920,141	$828,127	$0	$828,127
18	$949,461	$854,515	$0	$854,515
19	$976,950	$879,255	$0	$879,255
20	$1,002,423	$902,181	$0	$902,181
21	$1,025,706	$923,135	$0	$923,135
22	$1,046,638	$941,974	$0	$941,974
23	$1,065,078	$958,570	$0	$958,570
24	$1,058,850	$952,965	$0	$952,965
25	$1,072,195	$964,975	$0	$964,975
26	$1,082,784	$974,506	$0	$974,506
27	$1,090,551	$981,496	$0	$981,496
28	$798,307	$718,477	$0	$718,477
29	$777,338	$699,604	$0	$699,604
30	$742,238	$668,014	$0	$668,014
31	$735,740	$662,166	$0	$662,166
32	$408,738	$367,864	$0	$367,864
33	$362,746	$326,471	$0	$326,471
34	$308,258	$277,432	$0	$277,432
35	$308,985	$278,086	$0	$278,086
36	$308,857	$277,971	$0	$277,971
37	$307,880	$277,092	$0	$277,092
38	$306,066	$275,459	$0	$275,459
39	$0	$0	$0	$0
NPV		$11,779,486	$2,085,429	$9,694,057
IRR				24.1%
B/C ratio				5.6
Payback (years)				5.9

Expressing the Investment Analysis Results

Economists and financial experts have different ways of expressing investment analysis results. The standard and most familiar ones are the ones we present here: the **net present value** (NPV) is a dollar measure, the **internal rate of return** (IRR) is expressed as a percentage return on investment; the **benefit/cost ratio** (B/C) is simply a ratio of how many dollars worth of benefits are received per cost dollar; and the **payback period** is a simple calculation of how many years worth of benefits will be needed before all of the investments are recovered. The net present values, rates of return, benefit/cost ratios and payback periods are all derived from the same data (shown in **Tables 3.6, 3.7,** and **3.8** for the student and the broad and narrow taxpayer perspectives, respectively).

Readers unfamiliar with the interpretation of these standard investment analysis results are encouraged to consult the short layman's guide provided in **Appendix 2** of this report: "Explaining the Results—a Primer." A glossary of terms is also provided in **Appendix 1**.

Does attending the 16 Maryland community colleges make economic sense for the students? The answer is a resounding **yes**. The future stream of benefits (higher earnings) accruing to the students has a net present value of $9.7 billion **(Table 3.6)**—a positive net present value (greater than zero) indicates that the investments made are strongly feasible. The benefit/cost ratio of 5.6 is strongly positive since the ratio is well above 1. The rate of return of 24.1% is also well above the long-term rates of return obtainable in the stock or bond markets, and certainly above the 4.0% discount rate used in the analysis. In the long run, therefore, the average student will be substantially better

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off attending a community college. The payback period for a student (tuition plus the earnings foregone) is 5.9 years – the higher earnings received beyond that period are pure economic rent – or a persistent earnings flow over and beyond the initial investments.

The Broad Taxpayer Perspective

Table 3.7 assesses one year's operation of the community colleges from the broad taxpayer perspective. The Legislature, on behalf of taxpayers, must weigh requests for funding against the myriad other public needs. As such, they need information to better allocate increasingly scarce resources between alternative and competing ends. Column 1 shows the stream of total benefits, including increased earnings, and social savings from reduced spending on incarceration, health, welfare, and unemployment. Specifics on the estimation of values in Column 1 are presented in **Volume 2: Detailed Results, Table 19**. Column 2 adjusts for the 22% alternative education opportunity assumption (the percentage of the student body able to avail themselves of similar education elsewhere, absent the Maryland community colleges). Column 3 conveys an adjustment needed to account for the fact that some of the community colleges might be able to operate at some level of enrollment absent state and local government support, i.e., by raising tuition (see **Appendix 4** for technical details). Column 4 is simply Column 1 less Column 2 and Column 3. Column 5 shows the state and local taxpayer costs for a single year, as reflected in state and local tax items in **Table 2.1**. Finally, Column 6 considers the broad perspective on the taxpayer's investment in a cash flow sense, subtracting annual costs from annual benefits.

The net present value given this broad perspective is $6.2 billion and the benefit/cost ratio is 15.0. **More succinctly, every dollar of tax monies spent on community college education will generate a cumulative total of $14.99 worth of social savings (accrued incrementally) for as long as the students are active in the workforce.**[29]

[29]A word of caution – the RR approach sometimes generates percentage results that defy the imagination. Technically, the approach requires at least one negative cash flow (tuition plus opportunity cost of time) to offset all subsequent positive flows. A very high percentage return may be technically correct, but perhaps not consistent with conventional understanding of returns expressed as percentages. For purposes of the reports, therefore, we express all rates of return as: "NA" (particularly for the broad taxpayer perspective where high returns are expected). Only the benefit/cost ratio is reported for the broad taxpayer perspective.

Table 3.7: Taxpayer Perspective: Broad ($ Thousands)

Year	1 All Benefits	2 Benefits from Alt. Ed. Opportunities	3 Benefits w/o State & Local Gov Funding	4 Net Benefits	5 Total Taxpayer Costs	6 Less College Income Cash Flow
1	$971,353	$53,742	$0	$917,611	$458,831	$458,779
2	$230,288	$57,831	$0	$172,456	$0	$172,456
3	$306,968	$77,175	$0	$229,793	$0	$229,793
4	$323,224	$81,114	$0	$242,109	$0	$242,109
5	$339,735	$85,093	$0	$254,642	$0	$254,642
6	$356,418	$89,089	$0	$267,329	$0	$267,329
7	$373,187	$93,080	$0	$280,107	$0	$280,107
8	$389,948	$97,043	$0	$292,905	$0	$292,905
9	$406,605	$100,953	$0	$305,652	$0	$305,652
10	$423,060	$104,788	$0	$318,273	$0	$318,273
11	$439,212	$108,520	$0	$330,692	$0	$330,692
12	$454,958	$112,127	$0	$342,831	$0	$342,831
13	$470,196	$115,584	$0	$354,612	$0	$354,612
14	$484,825	$118,868	$0	$365,958	$0	$365,958
15	$498,747	$121,954	$0	$376,793	$0	$376,793
16	$511,864	$124,822	$0	$387,042	$0	$387,042
17	$524,086	$127,451	$0	$396,635	$0	$396,635
18	$535,327	$129,823	$0	$405,504	$0	$405,504
19	$545,506	$131,920	$0	$413,586	$0	$413,586
20	$554,550	$133,726	$0	$420,823	$0	$420,823
21	$562,394	$135,230	$0	$427,164	$0	$427,164
22	$568,982	$136,420	$0	$432,562	$0	$432,562
23	$574,267	$137,288	$0	$436,979	$0	$436,979
24	$571,997	$136,896	$0	$435,101	$0	$435,101
25	$574,847	$137,146	$0	$437,701	$0	$437,701
26	$576,315	$137,064	$0	$439,251	$0	$439,251
27	$576,395	$136,653	$0	$439,742	$0	$439,742
28	$406,625	$81,623	$0	$325,002	$0	$325,002
29	$393,529	$80,441	$0	$313,088	$0	$313,088
30	$369,596	$75,489	$0	$294,107	$0	$294,107
31	$363,806	$74,599	$0	$289,207	$0	$289,207
32	$201,449	$33,367	$0	$168,082	$0	$168,082
33	$181,493	$28,978	$0	$152,516	$0	$152,516
34	$148,754	$20,837	$0	$127,918	$0	$127,918
35	$148,200	$20,782	$0	$127,417	$0	$127,417
36	$147,273	$20,675	$0	$126,598	$0	$126,598
37	$145,982	$20,516	$0	$125,466	$0	$125,466
38	$144,338	$20,306	$0	$124,032	$0	$124,032
39	$0	$0	$0	$0	$0	$0
NPV				$6,612,720	$441,184	$6,171,536
IRR						NA
B/C ratio						15.0
Payback (years)						NA

The Narrow Taxpayer Perspective

Table 3.8 provides an investment analysis of the Maryland community colleges from the narrow taxpayer perspective. Recall from **Chapter 2** that the narrow perspective considers only monies that actually appear on the books of state and local governments: revenue items such as tax receipts, and expenditure items such as road, bridge and street maintenance, police, public libraries and hospitals, jails and prisons, welfare payments, and so on.

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Table 3.8, Column 1 shows additions to state and local government revenues stemming from the operation of the Maryland community colleges during the single analysis year. The values in Column 1 are computed by applying average state and local government tax rates to the net increase in statewide income attributed to the Maryland community college system.[30] Also included in Column 1 are reductions (entered as negatives) in state and local government expenditures on crime, welfare, unemployment, and health. Projected dollar amounts in Column 1 are thus the sum of additional taxes collected, plus associated tax dollars saved as a result of the education provided by the colleges during the single analysis year.

Column 2 reflects the adjustment attributable to the alternative education variable, while Column 3 reflects the ability of some of the community colleges to operate without the current level of state and local government support, as discussed above and in **Appendix 4**. Column 4 shows net benefits, Column 1 minus Columns 2 and 3. Column 4 shows state and local government costs, taken directly from **Table 2.1**. Finally, Column 6 subtracts state and local government cost from benefits, thereby providing the temporal cash flow needed for the investment analysis. As shown at the bottom of the table, the colleges provide state and local government with an aggregate annual return of $469.4 million expressed as a net present value on its one-year investment. Alternatively, the one-year investment generates an 11.9% rate of return and a benefit/cost ratio of 2.1, both indicating that the investment is attractive. The payback period is 10.2 years.

The returns shown in **Table 3.8** would be attractive even in the private sector, and they are very attractive in the public sector. Recall that the public sector generally undertakes those activities the private sector finds unprofitable, i.e., investments that generate book revenues insufficient to cover book costs, thus requiring taxpayer subsidy. For example, state governments fund the operation and maintenance of state parks at a substantial loss, collecting revenues in the form of camping and entrance fees that cover only a fraction of costs. Taxpayers are willing to subsidize parks because they perceive off-budget benefits, e.g., access to the outdoors, state development effects, environmental protection, and so on, that justify the budgetary losses. Note that this broader collection of off-budget benefits would normally be captured in the broad taxpayer perspective.

[30] Increased income includes a portion of direct student earnings, salaries, and wages at the colleges during the single analysis year, and an additional increment aimed at a collection of backward and forward multiplier effects.

Table 3.8. Taxpayer Perspective: Narrow ($ Thousands)

Year	1 Total Taxpayer Benefits	2 Benefits from Alt. Ed. Opportunities	3 Benefits w/o State & Local Gov Funding	4 Net Taxpayer Benefits	5 Total Taxpayer Costs	6 Net Cash Flow
1	$134,144	$5,631	$0	$128,513	$458,831	($330,319)
2	$30,957	$7,725	$0	$23,232	$0	$23,232
3	$41,649	$10,422	$0	$31,227	$0	$31,227
4	$43,926	$10,975	$0	$32,951	$0	$32,951
5	$46,238	$11,533	$0	$34,705	$0	$34,705
6	$48,575	$12,093	$0	$36,481	$0	$36,481
7	$50,922	$12,653	$0	$38,269	$0	$38,269
8	$53,269	$13,209	$0	$40,060	$0	$40,060
9	$55,601	$13,757	$0	$41,844	$0	$41,844
10	$57,904	$14,295	$0	$43,610	$0	$43,610
11	$60,166	$14,818	$0	$45,348	$0	$45,348
12	$62,370	$15,324	$0	$47,046	$0	$47,046
13	$64,504	$15,809	$0	$48,695	$0	$48,695
14	$66,552	$16,270	$0	$50,283	$0	$50,283
15	$68,502	$16,703	$0	$51,799	$0	$51,799
16	$70,340	$17,106	$0	$53,234	$0	$53,234
17	$72,053	$17,475	$0	$54,578	$0	$54,578
18	$73,629	$17,809	$0	$55,820	$0	$55,820
19	$75,057	$18,104	$0	$56,953	$0	$56,953
20	$76,327	$18,359	$0	$57,968	$0	$57,968
21	$77,430	$18,571	$0	$58,859	$0	$58,859
22	$78,357	$18,740	$0	$59,617	$0	$59,617
23	$79,103	$18,864	$0	$60,239	$0	$60,239
24	$78,811	$18,814	$0	$59,997	$0	$59,997
25	$79,217	$18,852	$0	$60,365	$0	$60,365
26	$79,431	$18,844	$0	$60,587	$0	$60,587
27	$79,451	$18,789	$0	$60,662	$0	$60,662
28	$56,290	$11,282	$0	$45,008	$0	$45,008
29	$54,491	$11,120	$0	$43,371	$0	$43,371
30	$51,204	$10,440	$0	$40,764	$0	$40,764
31	$50,404	$10,317	$0	$40,087	$0	$40,087
32	$27,959	$4,617	$0	$23,342	$0	$23,342
33	$25,204	$4,011	$0	$21,193	$0	$21,193
34	$20,682	$2,887	$0	$17,795	$0	$17,795
35	$20,605	$2,879	$0	$17,726	$0	$17,726
36	$20,476	$2,865	$0	$17,612	$0	$17,612
37	$20,297	$2,843	$0	$17,454	$0	$17,454
38	$20,068	$2,814	$0	$17,255	$0	$17,255
39	$0	$0	$0	$0	$0	$0
NPV				$910,566	$441,184	$469,381
IRR						11.9%
B/C ratio						2.1
Payback (years)						10.2

Investments in public education are usually viewed in the same way as investments in parks and other publicly subsidized activities, i.e., activities that generate losses from a narrow investment perspective but are justified by net benefits from a broad investment perspective. As shown in **Table 3.8,** however, the 16 Maryland community colleges are a notable exception to this general net-subsidy rule. The narrow perspective rate of return is strongly positive, and thereby indicates that the taxpayers' investments in the

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colleges generate increased public revenues and reduced expenditures that actually exceed the subsidy by taxpayers. **The practical effect of this is the following: if the investments made in the Maryland community colleges were reduced, taxes would have to be raised in order for state and local governments to continue their support of other activities at current levels. The taxpayer investments of 59% of the total revenues (Table 2.1), in effect, subsidize other sectors of the economy that also receive taxpayer support. The simple bottom line from the narrow taxpayer perspective is that benefits accruing to the taxpayers far outweigh the relatively low investments they make in the colleges.**

With and Without Social Benefits

In **Chapter 2** the social benefits attributable to CC education (reduced crime, welfare and unemployment, and improved health) were defined as *external benefits*, incidental to the operations of the colleges. Colleges do not directly aim at creating these benefits. Some would question the legitimacy of including these benefits in the calculation of the rates of return to higher education, arguing that only the direct benefits—the higher earnings—should be counted. **Tables 3.7** and **3.8** are both inclusive of the social benefits reported here as attributable to the colleges. Recognizing the other point of view, **Table 3.9** shows the rates of return for both the broad and narrow perspectives exclusive of the social benefits. As indicated, the returns are still well above the threshold values (a benefit/cost ratio greater than 1) confirming that the taxpayers receive great value from investing in Maryland's community colleges.

Table 3.9. Taxpayer Perspective ($ Thousands)

	Broad Perspective With Social Savings		Narrow Perspective With Social Savings	
	Included	Excluded	Included	Excluded
NPV	$6,171,536	$5,482,438	$469,381	$383,740
IRR	NA	NA	11.9%	10.4%
B/C ratio	15.0	13.4	2.1	1.9
Payback (years)	NA	NA	10.2	11.4

Summary

A summary of the investment analysis results (also reported in **Tables 3.6 – 3.8** above) is provided in **Table 3.10,** on aggregate, per CHE, and per student bases. The pie chart in **Figure 3.3** shows the breakdown of the present values of the aggregate benefits, taken from **Table 3.10**. **Figure 3.4** shows the breakdown of the investments made by the students (tuition and fees plus opportunity cost of time) and the contribution made by the state through local taxes and appropriations (see "PV of all costs" in **Table 3.10**).

Table 3.10. Summary of Investment Analysis Results

	Aggregate	Per CHE	Per Student
PV of student benefits, increased earnings	$ 11,779,485,828	$3,280	$ 31,416
Health benefits, captured by society			
PV of absenteeism savings	$ 284,405,879	$79	$ 759
PV of tobacco and alcohol abuse medical savings	$ 263,929,774	$73	$ 704
Crime			
PV of reduced incarceration	$ 68,358,922	$19	$ 182
PV of reduced victim costs	$ 75,287,107	$21	$ 201
PV of earnings (opportunity gained)	$ 35,919,386	$10	$ 96
Unemployment and welfare			
PV of reduced welfare rolls	$ 253,387,786	$71	$ 676
PV of reduced unemployment	$ 215,207,703	$60	$ 574
Sum of all present values, benefits	$ 12,975,982,386	$ 3,613	$ 34,607
PV of all costs			
PV of state and local contribution to college budget	$ 458,831,474	$128	$ 1,224
PV of opportunity cost of education plus tuition	$ 2,168,846,000	$604	$ 5,784
Sum of all present values, costs	$ 2,627,677,474	$ 732	$ 7,008
NPV, Student Perspective ($ Thousands)		$9,694,057	
RR, Student Perspective		24%	
B/C Ratio, Student Perspective		5.6	
Payback Period, Student Perspective		5.9	
NPV, Taxpayer Perspective: Broad ($ Thousands)		$6,171,536	
RR, Taxpayer Perspective: Broad		NA	
B/C Ratio, Taxpayer Perspective: Broad		15.0	
Payback Period, Taxpayer Perspective: Broad		NA	
NPV, Taxpayer Perspective: Narrow ($ Thousands)		$469,381	
RR, Taxpayer Perspective: Narrow		11.9%	
B/C Ratio, Taxpayer Perspective: Narrow		2.1	
Payback Period, Taxpayer Perspective: Narrow		10.2	

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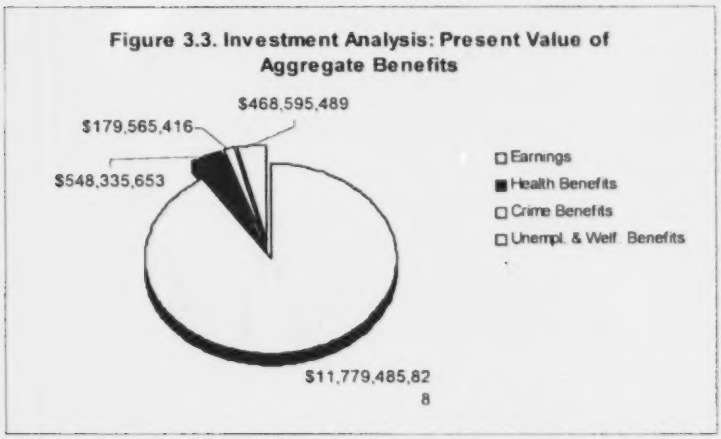

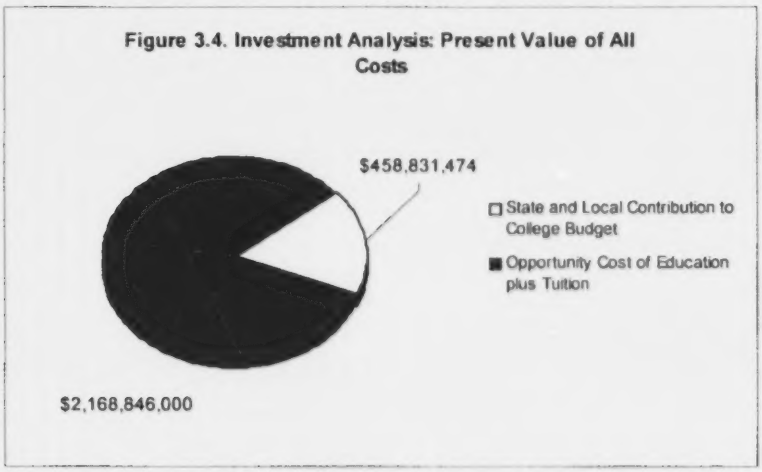
Figure 3.4. Investment Analysis: Present Value of All Costs
$458,831,474
$2,168,846,000
State and Local Contribution to College Budget
Opportunity Cost of Education plus Tuition

STATEWIDE ECONOMIC BENEFITS

The 16 Maryland community colleges play an important role in the resiliency, growth, and development of the state economy. In 2002, the State of Maryland generated overall earnings (wages, salaries, and proprietors' income) equal to $134.7 billion.[31] The portion of this total credited to the existence of the 16 Maryland community colleges is discussed

[31] Total earnings for the State of Maryland are obtained from Woods & Poole Economics, Inc. (see www.woodsandpoole.com). Woods & Poole Economics, Inc. specializes in county-level economic and demographic projections. Their earnings estimates are based on estimates published by the US Department of Commerce, Regional Economic Information System (REIS), projected forward on the basis of historic trends.

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in the four subsections below, both in the aggregate and with industry detail. The industry-specific analysis highlights Maryland's CCs' contribution to the statewide business community.

We begin with the day-to-day operating and capital expenditures of the colleges. These are fed into the regional IO model to estimate the earnings impacts generated by industry. Next, we consider the value of workforce-embodied CHEs to the earnings of past students, and then we estimate the net portion that can be counted as increased regional income—the *direct impact* of past Maryland CC instruction. In the third section we utilize the multipliers of the regional IO model and estimate the *indirect impact* of past Maryland CC instruction on statewide earnings. In the fourth and final subsection we combine the three separate effects: 1) CC operations and capital spending effects, 2) past student direct effects, and 3) past student indirect effects, to arrive at the overall aggregate effect of Maryland's community colleges on earnings in the state.

Earnings Linked to Operation and Capital Spending

Table 2.10 in **Chapter 2** shows the 16 Maryland CCs' operating and capital spending during the analysis year. The last column (Column 6) of that table shows how much of the overall spending is captured by state vendors and other suppliers, i.e., the portion that stays in the state economy. The values in Column 6 are applied to the Maryland IO model to estimate the associated multiplier effects.

Table 3.11 shows the results of the IO multiplier analysis of the operating and capital spending of Maryland's CCs. Column 1 is for reference, showing 2002 total earnings by industry. Column 2 shows the portion of total earnings explained by (or accounted for by) the spending of Maryland's CCs, and Column 3 shows college-linked earnings as a percentage of total earnings by industry. For example, the construction sector in the State of Maryland had $9.6 billion in total earnings in 2002. Of this, Maryland's CCs' spending accounts for $18.6 million (or 0.2%). Similarly, the business services sector (services to buildings, advertising, reproduction, legal and accounting services, etc.) had $16.8 billion in total earnings in 2002, of which $41.8 million (or 0.2%) was explained by Maryland's CCs' spending. All told, the spending of Maryland's community colleges explained $755.4 million, or 0.6% of all statewide earnings in 2002.

Table 3.11. Earnings Linked to Maryland's CCs' Operations Expenditures

Industries	Earnings: Baseline ($ Thousands) 1	Earnings: College-Linked ($ Thousands) 2	% College-Linked 3
Agriculture and Agricultural Services	$1,096,012	$601	0.1%
Mining, Sand, and Gravel	$113,840	$194	0.2%
Construction	$9,601,392	$18,583	0.2%
Manufacturing: Food, Wood, Paper, and Textiles	$2,375,622	$311	0.0%
Manufacturing: Chemicals, Petroleum, Stone, and Glass	$4,770,083	$274	0.0%
Manufacturing: Computer and Electronic Equipment	$781,671	$258	0.0%
Manufacturing: Other	$2,216,408	$1,723	0.1%
Transportation	$2,714,560	$6,038.0	0.2%
Public Utilities	$967,838	$5,937	0.6%
Publishing and Communications	$3,741,798	$10,628	0.3%
Trade	$18,610,243	$46,900	0.3%
Finance, Insurance, and Real Estate	$11,821,155	$29,274	0.2%
Motels, Eating/Drinking, and Amusement/Recreation	$5,354,979	$17,929	0.3%
Consumer Services	$8,991,245	$11,612	0.1%
Business Services	$16,753,418	$41,794	0.2%
Medical/Educational/Social Services	$15,573,324	$44,076	0.3%
Federal Government	$14,933,913	$2,181	0.0%
State and Local Government (less the college)	$13,759,874	$9,432	0.1%
Maryland's CCs	$507,694	$507,694	100.0%
Total	$134,685,068	$755,438	0.6%

Past Student Economic Development Effects: The Direct Effect

Switching now to the past students, the objective is to assign value to the embodied CHEs still operative in the statewide workforce. These skills increase the productivity of the statewide workforce: existing industry becomes more efficient, competitive, and able to expand product lines. Also, new industry can be attracted to the state. The net effect is an enlargement of the statewide income, whether existing industry expands or new industry is created.

In **Table 2.13** we derived an estimate of 62.6 million of past CHEs embodied in the present-day statewide workforce. In **Table 3.12**, we detail the steps that take us from CHEs embodied in the workforce to an estimate of the *net* impact of Maryland's CCs' instruction on statewide earnings:

- Step 1: We show the 62.6 million of past CHEs embodied in the current workforce.
- Step 2: As shown earlier in this chapter (**Table 3.3**), the average net value for earnings was reported as $152. The net value was derived as the gross value less

10%.[32] For the statewide economic development effect, however, we need to begin with the *gross* value per CHE, or $167.

- Step 3: The product of the total embodied CHEs and the gross value per CHE comprises the initial estimate of the aggregate addition of Maryland's CCs' instruction to past student earnings.

- Step 4: In **Chapter 2**, **Table 2.2** we described the source and meaning of the "alternative education opportunity variable." Absent Maryland's CCs, 22.2% of the students would still be able to obtain their education elsewhere. This portion of the added earnings is not credited to Maryland's community colleges in the calculation of statewide growth effects for reasons stated in the previous chapter. The initial estimate of the aggregate addition to past student earnings, therefore, is restated as the net of the alternative education opportunity, indicated in **Table 3.12**.

- Step 5: Finally, the last adjustment reduces the earnings of past students to all but 33% of the previous number. As discussed in detail in **Chapter 2** (see text box on polar cases), the reasons for the significant discounting of past student earnings pertains largely to issues of worker substitution, i.e., the substitution of state skilled for state unskilled workers, and the substitution of out-of-state workers for in-state workers. As for the specific 33% value, this is borrowed from the economics literature on national income growth and education (see: Bils and Klenow, 2000).

Table 3.12. Estimating the Net Statewide Income Effect of Embodied CHEs

	Variables
Total embodied CHEs	62,641,472
Gross Value per CHE	$167
Increased earnings of past students	$10,479,625,063
Alternative education variable, %	22%
Gross earnings attributable to Maryland's CCs, net of alternative education variable	$8,150,781,047
Substitution Effects Rate	33%
Net earnings attributable to Maryland's CCs	$2,689,757,745

[32] **Table 3.3** assigns a $152 net value per CHE of instruction at Maryland's CCs. This is a net value reflecting a 10% reduction from the gross value to account for a collection of correlation-causation factors as discussed in **Chapter 2** under the section "Annual Private Benefits." Rather than *personal* income effects, however, the present section looks at *regional* income effects. Estimating the latter entails an entirely different set of correlation-causation adjustments; hence, we start again with the gross value.

As shown in the last entry of **Table 3.12**, our analysis concludes that earnings in the State of Maryland are $2.7 billion larger than they would be otherwise, because of the skills of past students embodied in the present-day workforce.

The statewide business community is naturally interested in how the 16 Maryland community colleges affect its operations. This is shown in **Table 3.13**. The distribution of historic past student CHEs by industrial sector is translated in **Table 3.13** into the increase in aggregate earnings across these same industrial sectors. The distribution of aggregate earnings is based on the distribution of past student CHEs (**Table 2.13**, Column 4), weighted according to relative industry earnings.

The dollar figures shown in Column 2 of **Table 3.13** indicate how much larger the earnings in these industries are as a direct result of the Maryland CC skilled workers they employ. The Finance, Insurance, and Real Estate sector, for example, is estimated to employ Maryland CC students with a combined 10,271,838 hours of CHEs (see **Table 2.13**). Because of the skills of these past students, the Finance, Insurance, and Real Estate sector is estimated to generate earnings that are $435.1 million (or 3.7%) larger than they would be otherwise. The benefit to the business community is simply this: additional earnings mirror additional business volume, sales revenues, and property incomes. The direct effect of past students on other sectors is shown in the table. The statewide direct effect of past student skills are shown in the bottom row of **Table 3.13**: overall regional earnings are $2.7 billion (or 2.0%) higher than they would be if the 16 Maryland community colleges did not exist.

Earnings are larger because outputs are larger, existing industries produce more, and new industries are attracted to the state by the existence of a skilled workforce. The earnings effects shown in **Table 3.13** are called *direct effects*, because they reflect a portion of the increased earnings of past students themselves.

Table 3.13. Past Student Direct Effects

Industries	Earnings		
	Baseline	College-Linked	% College Linked
	----------($ Thousands)----------		
	1	2	3
Agriculture and Agricultural Services	$1,096,012	$2,017	0.2%
Mining, Sand, and Gravel	$113,840	$209	0.2%
Construction	$9,601,392	$17,669	0.2%
Manufacturing: Food, Wood, Paper, and Textiles	$2,375,622	$21,859	0.9%
Manufacturing: Chemicals, Petroleum, Stone, and Glass	$4,770,083	$87,781	1.8%
Manufacturing: Computer and Electronic Equipment	$781,671	$28,769	3.7%
Manufacturing: Other	$2,216,408	$40,787	1.8%
Transportation	$2,714,560	$24,977	0.9%
Public Utilities	$967,838	$8,905	0.9%
Publishing and Communications	$3,741,798	$137,716	3.7%
Trade	$18,610,243	$342,474	1.8%
Finance, Insurance, and Real Estate	$11,821,155	$435,076	3.7%
Motels, Eating/Drinking, and Amusement/Recreation	$5,354,979	$49,272	0.9%
Consumer Services	$8,991,245	$82,730	0.9%
Business Services	$16,753,418	$308,304	1.8%
Medical/Educational/Social Services	$15,573,324	$573,174	3.7%
Federal Government	$14,933,913	$274,820	1.8%
State and Local Government	$14,267,568	$253,215	1.8%
Total	$134,685,068	$2,689,758	2.0%

Past Student Economic Development Effects: The Indirect Effect

To the direct effects shown in **Table 3.13**, we must now add *indirect effects* stemming from the action of the regional multiplier process. As earnings increase because of higher industry output, the demand for additional industry inputs increases as well. Moreover, with the higher *direct* earnings (shown in **Table 3.13**), workers have more money to spend, which increases sales in consumer-oriented sectors of the economy. On top of these added business inputs and worker expenditures, the action of the state multiplier generates still further rounds of industry output and earnings.[33]

There is another part to the indirect effect. Economic development theory describes an *agglomeration effect* whereby regional growth itself stimulates growth (see "The Indirect Economic Development Effects of Students" discussion in **Chapter 2**). In general, agglomeration occurs when additional state output attracts new industry, facilitates

[33] The multiplier effects described in this paragraph are traditional "backward" multiplier effects, and are estimated by applying the change in sectoral earnings shown in Table 3.13 to the Maryland IO model.

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economies of scale, enhances workforce efficiency through information sharing, and otherwise enhances the statewide business climate.[34]

Table 3.14 shows the total of the various indirect effects that accompany the direct effects of **Table 3.13**. These effects reflect increased business outputs independent of the actual employment of past students in particular sectors (i.e., they reflect the action of the multiplier process).

Table 3.14. Past Student Indirect Effects

	Earnings		
	Baseline	College-Linked	% College-Linked
	----------($ Thousands)----------		
Industries	1	2	3
Agriculture and Agricultural Services	$1,096,012	$16,854	1.5%
Mining, Sand, and Gravel	$113,840	$1,126	1.0%
Construction	$9,601,392	$43,045	0.4%
Manufacturing: Food, Wood, Paper, and Textiles	$2,375,622	$5,963	0.3%
Manufacturing: Chemicals, Petroleum, Stone, and Glass	$4,770,083	$17,368	0.4%
Manufacturing: Computer and Electronic Equipment	$781,671	$8,177	1.0%
Manufacturing: Other	$2,216,408	$19,594	0.9%
Transportation	$2,714,560	$61,271	2.3%
Public Utilities	$967,838	$25,782	2.7%
Publishing and Communications	$3,741,798	$123,391	3.3%
Trade	$18,610,243	$326,585	1.8%
Finance, Insurance, and Real Estate	$11,821,155	$320,863	2.7%
Motels, Eating/Drinking, and Amusement/Recreation	$5,354,979	$132,245	2.5%
Consumer Services	$8,991,245	$116,165	1.3%
Business Services	$16,753,418	$288,527	1.7%
Medical/Educational/Social Services	$15,573,324	$330,842	2.1%
Federal Government	$14,933,913	$102,829	0.7%
State and Local Government	$14,267,568	$230,585	1.6%
Total	$134,685,068	$2,171,211	1.6%

Focusing on particular effects, we can now say that because of the indirect effect of past students, earnings in the Publishing and Communications sector will be $123.4 million (or 3.3%) higher than would otherwise be the case. Other indirect sectoral effects are as shown in the table. The bottom row of **Table 3.14** indicates that statewide total earnings are $134.7 billion, of which $2.2 billion (or 1.6%) are due to the indirect effect of past students.

[34] We estimate agglomeration effects as "forward" multiplier effects. The Maryland IO model is configured to provide a set of so-called supply-driven multipliers (see for example Miller and Blair, 1985). Agglomeration effects are obtained by applying the change in higher stage sectoral earnings from **Table 3.13** to the supply-driven form of the Maryland IO model.

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Overall Effect of Maryland's CCs on the Statewide Economy

The tables above detail the regional economic effects attributable to Maryland's community colleges in three parts. The effect of day-to-day college operations and capital spending is shown in **Table 3.11**. The direct effect of past students still active in the workforce is shown in **Table 3.13**. Finally, the indirect effect of past students still active in the workforce is shown in **Table 3.14**. **Table 3.15** combines these separate effects into one summary table.

Table 3.15. Total Effect

	Earnings		
	Baseline	College-Linked	% College-Linked
	----------($ Thousands)----------		
Industries	1	2	3
Agriculture and Agricultural Services	$1,096,012	$19,472	1.8%
Mining, Sand, and Gravel	$113,840	$1,530	1.3%
Construction	$9,601,392	$79,296	0.8%
Manufacturing: Food, Wood, Paper, and Textiles	$2,375,622	$28,133	1.2%
Manufacturing: Chemicals, Petroleum, Stone, and Glass	$4,770,083	$105,423	2.2%
Manufacturing: Computer and Electronic Equipment	$781,671	$37,204	4.8%
Manufacturing: Other	$2,216,408	$62,104	2.8%
Transportation	$2,714,560	$92,286	3.4%
Public Utilities	$967,838	$40,624	4.2%
Publishing and Communications	$3,741,798	$271,735	7.3%
Trade	$18,610,243	$715,959	3.8%
Finance, Insurance, and Real Estate	$11,821,155	$785,212	6.6%
Motels, Eating/Drinking, and Amusement/Recreation	$5,354,979	$199,446	3.7%
Consumer Services	$8,991,245	$210,507	2.3%
Business Services	$16,753,418	$638,625	3.8%
Medical/Educational/Social Services	$15,573,324	$948,092	6.1%
Federal Government	$14,933,913	$379,830	2.5%
State and Local Government (less the college)	$13,759,874	$493,232	3.6%
Maryland's CCs	$507,694	$507,694	100.0%
Total	$134,685,068	$5,616,407	4.2%

Individual rows in **Table 3.15** show how particular industries benefit from the past and present existence of the 16 Maryland community colleges. For example, our analysis suggests the State of Maryland's Publishing and Communications sector owes $271.7 million (or 7.3%) of its overall earnings to the past and present existence of Maryland's CCs. The effect of Maryland's CCs on other industries is shown in the table. The bottom row of **Table 3.15** indicates that region-wide earnings are $134.7 billion, of which $5.6 billion (or 4.2%) are due to the past and present existence of the 16 Maryland community colleges.

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Table 3.16. Summary of CCs' Role in the State Economy

	Earnings ($ Thousands)	% of Total	Multipliers
Total Earnings in State	$134,685,068	100%	
Earnings Attributable to CC Operations			
Direct Earnings of Faculty and Staff	$507,694	0.4%	
Indirect Earnings	$247,744	0.2%	
TOTAL	$755,438	0.6%	1.4880
Earnings Attributable to Past Student Econ. Dev. Effects			
Direct Earnings	$2,689,758	2.0%	
Indirect Earnings	$2,171,211	1.6%	
TOTAL	$4,860,969	3.6%	1.8072
GRAND TOTAL	$5,616,407	4.2%	

Table 3.16 provides one last view of the regional economic effects of Maryland's community colleges, a fully aggregated view with no industry detail. Consider the items under the heading "Earnings Attributable to CC Operations." The first item is simply the earnings of the faculty and staff of the 16 Maryland community colleges, $507.7 million, or 0.4% of overall statewide earnings (this item is also shown in college spending, **Table 2.10**). The second item shows the indirect effect of the colleges' operations and capital spending: $247.7 million, or 0.2% of all statewide earnings. All told, the operations and capital spending of the 16 Maryland community colleges can be credited with $755.4 million, or 0.6% of the State of Maryland's $134.7 billion in overall earnings.

The next set of items detail the effect of past students still active in the State of Maryland workforce. Past students directly explain $2.7 billion, or 2.0% of all statewide earnings (shown on the total row of **Table 3.13**). These same students indirectly explain $2.2 billion, or 1.6% of all statewide earnings (shown on the total row of **Table 3.14**). In all, past students still active in the workforce can be credited with $4.9 billion, or 3.6% of all earnings in the State of Maryland.

Finally, the bottom row of **Table 3.16** shows Maryland's CCs' overall role in the state's economy: $5.6 billion, or 4.2% of all statewide earnings.

Chapter 4
SENSITIVITY ANALYSIS OF KEY VARIABLES

INTRODUCTION

We conclude this study with a sensitivity analysis of some key variables on both the investment and regional economic development sides. The purpose of the sensitivity analysis is twofold:

1. *To set our approach apart from "advocacy" education impact analyses that promote community and technical college education.* Many of these may lack uniformity and use assumptions that will not stand up to rigorous peer scrutiny, and they often generate results that grossly overstate benefits. The approach taken here is to account for all relevant variables on both the benefit and cost sides as reflected in the conservatively estimated base case assumptions laid out in **Chapter 2**. The sensitivity tests include: 1) the impacts associated with changes in the student employment variables for the investment analysis, and 2) the addition of student spending and sales (as opposed to earnings only) to the regional economic development analysis.

2. *To test the sensitivity of the results associated with the assumptions for which college researchers have applied judgment and innovative thinking rather than hard data to estimate the numbers.* Some may even refer to these variables as educated guesswork. They include the "Alternative Education" and "Attrition Rate" variables discussed in **Chapter 2**.

THE STUDENT EMPLOYMENT VARIABLES

Probably the most difficult data to collect are for the two employment variables, because colleges generally do not collect this kind of information as a matter of formal routine. These variables include: 1) the percent of the students employed, and 2) of those employed, the earnings received by the students relative to the full earnings they would have received if not attending Maryland's CCs. Both employment variables relate to the earnings foregone by the students—the opportunity cost of time—and they affect the investment analysis results (net present value, rate of return, benefit/cost ratio, and payback period).

Percent of Students Employed

The students incur substantial expense by attending Maryland's community colleges because of the time they spend not gainfully employed. Some of that cost is recaptured if the student remains partially (or fully) employed while attending. It is estimated that 77% of the current student body is employed. We test this variable in the sensitivity analysis by changing this assumption to 100%. This change would mean that *all* of the students are employed, reducing the average opportunity cost of time accordingly.

Percent of Earnings Relative to Full Earnings

The second opportunity cost variable is more difficult to estimate. On average for all 16 colleges, it is estimated that the students working while attending classes earn only 74%, on average, of the earnings they would have statistically received if not attending the community colleges. This suggests that many of the students hold part-time jobs earning minimum wage (or less than their "statistical" wages). The model captures these differences and counts them as a part of the opportunity cost of time. As above, we test this variable in the sensitivity analysis by changing the assumption to 100%. This would mean that the students are fully employed, and the average opportunity cost of time would be reduced accordingly.

Results

The changed assumptions (both of which would be consistent with advocacy analyses) generate the results summarized in **Table 4.1**. Here, the base case assumptions taken from **Table 2.2** are reflected in the two shaded rows for the variables tested—77% for the portion of students employed, and 74% for their earnings relative to the statistical averages. These (base case) assumptions are held constant in the shaded rows for the student perspective. The sensitivity analysis results are shown in the non-shaded rows—the extent to which the investment analysis results would change if the two base case variables were increased to 100%, first separately, and second, together. Changing both assumptions to 100% (all students fully employed) would automatically increase the benefits because the opportunity cost of time would reduce to zero.

1. Increasing the students employed assumption from 77% to 100% first (holding all of the other assumptions constant), the rate of return, benefit/cost ratio, and payback

period results would improve to 45.5%, 11.1, and 3.5 years, respectively, relative to the base case results. The improved results are attributable to a lower opportunity cost of time—all students would be employed in this case.

2. Increasing the earnings relative to the statistical averages from 74% to 100% second (holding the second employment assumption constant at the base case level), the rate of return, benefit/cost ratio, and payback period results would improve to 49.1%, 11.9, and 3.3 years, respectively, relative to the base case results—a strong improvement over the base case results, again attributable to a lower opportunity cost of time.

3. Finally, increasing both of the above assumptions to 100% simultaneously, the rate of return, benefit/cost ratio, and payback period results would improve yet further to >100%, 41.3, and 1.1 years, respectively, relative to the base case results. This scenario assumes that all students are fully employed and earning full salaries (equal to the statistical averages) while attending classes. These results are unrealistic, albeit not uncommon for advocacy analyses.

Table 4.1 Sensitivity Analysis of Student Perspective

Variables	Assumptions	RR	B/C	Payback
1. Percent	77%	24.1%	5.6	5.9
Employed	100%	45.5%	11.1	3.5
2. Percent of	74%	24.1%	5.6	5.9
Earnings	100%	49.1%	11.9	3.3
1 = 100%, 2 = 100%		>100%	41.3	1.1

A final note to this section—we strongly emphasize that the base case results are very attractive—the results are all well above their threshold levels, and the payback periods are short. As clearly demonstrated here, advocacy results *appear* much more attractive, although they would overstate the benefits. The results presented in **Chapter 3** are *realistic*, indicating that investments in Maryland's CCs will generate excellent returns, well above the long-term average percent rates of return of roughly 7% in the stock and bond markets.

STATEWIDE ECONOMIC DEVELOPMENT

The economic impacts of higher education can be calculated in different ways. Our approach was to estimate the economic impacts of the 16 community colleges based on college operations and capital spending (**Table 3.16**), and the increased productivity effects of past students in the regional workforce. The impacts were expressed in terms of regional *earnings*, i.e., area wages, salaries and proprietors' income, published by the U.S. Department of Commerce.[35] Others often add student spending to the impacts and express the results in terms of sales instead of earnings—both will substantially inflate the numerical measures of the impacts so that they appear larger than they really are. In the present section we address these two issues: 1) the addition of student spending effects to impact estimates, and 2) the expression of economic impacts in terms of regional gross sales rather than earnings.

The Economic Impact of Student Spending

Students spend money while attending college: they buy books and supplies, rent rooms, purchase food, pay for transportation, attend sports events, go to movies, and so on. These expenditures create jobs and incomes for state businesses, which, as argued by some, should be counted among the regional economic impacts attributable to the colleges.

In our analysis, however, we exclude student spending because most of the students already reside in state. Student expenditures, therefore, do not represent new monies in the region, but rather a redirection of monies that would have been spent anyway. The other side of the argument is that, even though the college-related spending of a resident student does not constitute new money, some students would leave the state to obtain an education elsewhere if the colleges were not present. Thus, the state loses the spending and related jobs and incomes. Both cases have merit, although we believe the former is more reasonable than the latter. This is because only a few students will actually be able to avail themselves of an education elsewhere (see **Table 2.9**). Our

[35] U.S. Department of Commerce, Regional Economic Information System (REIS) data includes earnings estimates for counties and states, and is published annually in the ***Department's Survey of Current Business***. It is also readily available in electronic form.

approach, therefore, is to exclude student spending, recognizing at the same time, that the regional impact estimates may err on the conservative side.

In **Table 4.2** we show the potential magnitude of student spending effects in the state economy. The table parallels **Table 3.16** in the previous chapter, but adds the section "Earnings Attributable to Student Spending,"[36] creating some $396.9 million in additional earnings for the state businesses patronized by students (the direct effects), plus another $355.2 million in earnings stemming from related multiplier effects (indirect effects). Adding the student spending to the mix increases Maryland's CCs' total "explanatory power" of the regional earnings from 4.2% in **Table 3.16** to 4.7% in **Table 4.2**.

Table 4.2. Summary of CCs' Role in the State Economy - Earnings

	Earnings ($ Thousands)	% of Total
Total Earnings in State	$134,685,068	100%
Earnings Attributable to Student Spending		
Direct Earnings	$396,876	0.3%
Indirect Earnings	$355,170	0.3%
TOTAL	$752,045	0.6%
Earnings Attributable to CC Operations		
Direct Earnings of Faculty and Staff	$507,694	0.4%
Indirect Earnings	$247,744	0.2%
TOTAL	$755,438	0.6%
Earnings Attributable to Past Student Econ. Dev. Effects		
Direct Earnings	$2,689,758	2.0%
Indirect Earnings	$2,171,211	1.6%
TOTAL	$4,860,969	3.6%
GRAND TOTAL	$6,368,453	4.7%

Economic Impacts Reported as Gross Sales

Advocates sometimes favor gross sales over earnings as an impact measure, because sales are always larger than the earnings. Using this as an impact measure has notable drawbacks, however. An immediate drawback is that, unlike earnings, there is generally no published total against which a sales impact can be measured. More importantly

[36] We estimated student spending effects by borrowing average college student information from a study conducted for higher education economic impacts in Illinois (University of Illinois, 2000). Student spending by broad expenditure category was bridged to the sectors of the statewide economy input-output model. Adjustments were made consistent with the model's regional accounts to allow for spending leakages.

though, the most troublesome aspect of gross sales impact measures is captured in the following example:

> Two visitors spend $50,000 each in the economic region. One visits a local auto dealer and purchases a new luxury automobile. The other undergoes a medical procedure at the local county hospital. In terms of direct economic impact, both have spent $50,000. However, the expenditures will likely have very different meanings to the state economy. Of the $50,000 spent for the luxury automobile, perhaps $10,000 remains in-state as salesperson commissions and auto dealer income (part of the county's overall earnings), while the other $40,000 leaves the state for Detroit or somewhere else as wholesale payment for the new automobile. Contrast this to the hospital expenditure. Here perhaps $40,000 appears as physician, nurse, and assorted hospital employee wages (part of the county's overall earnings), while only $10,000 leaves the state, to pay for hospital supplies, or to help amortize building and equipment loans. In terms of sales, both have the same impact, while in terms of earnings, the former has one-fourth the impact of the latter.

Table 4.3 expresses the impact of Maryland's community colleges in terms of gross sales rather than earnings. Note that gross sales measures are everywhere larger than earnings. The economy-wide measure of total gross sales estimated by the economic model is $342.4 billion.[37] Direct local spending by students reflects their total spending, reduced by the estimated portion that leaks out-of-state to purchase goods produced elsewhere.[38] In the usual fashion, indirect effects reflect the action of local economic multiplier effects, also estimated by the economic model.

Direct state expenditures include all spending by the colleges for consumer items and for faculty and staff salaries. Both items are reduced to reflect purchases from outside the state. All told, the operation of the 16 colleges is estimated to explain some $14.8 billion in regional gross sales, a number substantially larger than the $6.4 billion explained by the colleges in regional gross earnings shown in **Table 4.2**.

While the gross sales impacts shown in **Table 4.3** are not incorrect, we prefer to report college impacts in terms of earnings (**Table 3.16**) rather than gross sales, because they reflect the economic realities in the state much more accurately. Advocacy studies, on

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[37] Simply stated, economy-wide gross sales are obtained by multiplying sector-specific regional earnings by a national estimate of sales-to-earnings.

[38] Students purchase gasoline for their cars, for example, and while the trade margin stays in-state, in most cases the producer price of gasoline itself will leak out to the oil-producing region.

the other hand, will often opt to express the results in terms of sales because the numbers are much more impressive. Such results, however, will likely not stand up to rigorous peer scrutiny in the economics profession.

Table 4.3. Summary of CCs' Role in the State Economy - Sales

	Gross Sales ($ Thousands)	% of Total
Total Gross Sales	$342,412,355	100%
Gross Sales Attributable to Student Spending		
Direct Spending by Students	$1,013,791	0.3%
Indirect Spending Effect	$899,193	0.3%
TOTAL	$1,912,984	0.6%
Gross Sales Attributable to CC Operations		
Direct Expenditures of CCs	$231,391	0.1%
Indirect Spending Effect	$407,713	0.1%
TOTAL	$639,104	0.2%
Gross Sales Attributable to Past Student Econ. Dev. Effects		
Direct Gross Sales	$6,796,441	2.0%
Indirect Gross Sales	$5,441,141	1.6%
TOTAL	$12,237,583	3.6%
GRAND TOTAL	$14,789,670	4.3%

The Attrition Rate

The sensitivity analysis used here is a simple tool often used to determine "switching" values, which occur when the investment results turn from positive to negative, or from attractive to non-attractive as the assumptions are varied up and down. If the results change dramatically with only a small variation in the assumption, then that assumption is sensitive. If the results do not change much, the assumption is not sensitive, and minute accuracy in its specification is less important. The sensitivity analysis is also used to demonstrate how some results become unrealistic when advocacy assumptions are invoked.

One variable has consistently raised concerns among institutional researchers— the "Attrition Rate" variable, discussed in detail in **Table 2.2**. It cannot be specified on the basis of hard data collected regularly by the colleges; rather, it is based on well-informed judgments made by faculty and staff intimately familiar with the student body. The attrition rate (17% in **Table 2.2**) characterizes the mobility of the exiting students out of the region over the next thirty years or so through retirement, out-migration and/or death. Given the nature of this variable and the difficulty in accurately specifying it, the

obvious question is: how great a role does the attrition rate play in the magnitude of the results? The results are presented in the sensitivity analysis **Table 4.4**.

Table 4.4 Sensitivity Analysis of Attrition Rate Variable ($ Thousands)

	-75%	-50%	-25%	Base Case	25%	50%	75%
Attrition Rate Variable	4.3%	8.6%	12.87%	17%	21.45%	25.7%	30.0%
Regional Economic Development							
Earnings Attributable to College	$5,948,897	$5,840,070	$5,729,290	$5,616,407	$5,501,253	$5,383,631	$5,263,319
% of Total Earnings in State	4.4%	4.3%	4.3%	4.2%	4.1%	4.0%	3.9%
Credits Embodied in the Workforce	66,926,147	65,523,724	64,096,143	62,641,472	61,157,518	59,641,774	58,091,354

The attrition rate variable only affects the regional economic development results (**Table 3.16**). Variations in the attrition rate are calculated around the base case assumption of 17% (from **Table 2.2**), shown in the middle column of **Table 4.4**. We bracket the base case assumption on either side with plus or minus 25%, 50% and 75% variation in the assumptions. The analyses are then redone introducing one change at a time, holding all the other variables constant. Earnings attributable to the colleges, for example, range from a high of $5.9 billion at -75% to a low of $5.3 billion at a 75% variation from the base case assumption for this variable. This means that, if the attrition of the ex-students over time increases, the number of CHEs embodied in the current state workforce decreases; hence, the earnings attributable to the colleges decrease accordingly.

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Appendix 1: Glossary of Terms

Alternative education	The alternative education variable is a "with" and "without" measure. In other words, it is a measure of the percent of students who would still be able to avail themselves of alternative education opportunities absent the community or technical colleges in the state. An estimate of 20%, for example, means that 20% of the students do not depend directly on the existence of the colleges in order to obtain their education. We then back 20% out the impact calculations.
Attrition rate	An attrition (decay) rate of students is applied to benefits occurring in the future. The rate refers to the fact that not all students remain in the local region once exiting the college, but some will out-migrate, retire or die. This rate is estimated by the college institutional researchers, or it is derived from the literature as a default value if the variable cannot be estimated by the college.
Benefit/cost ratio	The benefit/cost ratio separately discounts the flow of benefits and costs over time to the present and then divides the sum of the discounted benefits by the sum of the discounted costs. If the benefit/cost ratio is greater than one, then the benefits exceed costs and the investment is feasible. For every dollar expended we get more than one dollar back. This, however, does necessarily not mean that the investment is the best one. There are many feasible projects but only one optimal one. We must compare between investments—the higher the benefit/cost ratio, the more attractive the project.
Demand	The demand for education describes the relationship between the market price of education and the volume of education demanded (expressed in terms of enrollment). The law of the downward-sloping demand curve is related to the fact that enrollment increases only if the price (tuition and fees) is lowered, or

conversely, enrollment decreases if the price (tuition and fees) increases.

Discounting — Discounting is the process of expressing future revenues and costs in present value terms. The discount rate converts future revenues into present values so they can be compared to costs incurred in the present.

Economics — Economics is the study of the allocation of scarce resources among alternative and competing ends. Economics is not normative (what *ought* to be done), but positive (describes *what is*, or how people are likely to behave in response to economic changes). Allocation of resources is the key focus of economics. Taxpayer dollars, for example, are scarce and there will be competing uses and pressures guided by self-interest. Taxpayers vote to tax themselves to fund transportation, the health sector, and/or education and other priorities. They have choices and must allocate between them.

Elasticity of demand — In this report, the elasticity of demand refers to the degree of responsiveness of the quantity of education demanded (enrollment) to changes in market prices (tuition and fees). If a decrease in tuition increases total revenues, the demand is elastic. If it decreases total revenues, the demand is inelastic. If total revenues remain the same, the elasticity of demand is said to be unitary.

Externalities — Externalities occur when impacts are evident for which there is no compensation – this is a cost generated by the producer but not paid for by him. Hillside logging, for example, creates downstream erosion – this is caused by the logger but is not paid for by him.

Input-output analysis — Input-output analysis is a branch of economics that addresses production relationships in an economy. In particular, it refers to the relation between a given set of demands for final goods and services, and the implied amounts of manufactured inputs, raw

materials, and labor this requires. In an educational setting, as colleges pay wages and salaries and spend money for supplies in the local economic region, they also generate earnings in all of the sectors of the economy, thereby increasing the demand for goods and services and jobs. Moreover, as the students are added to or rejoin the workforce with higher skills obtained at the colleges, they also earn higher salaries and wages. In turn, this generates more consumption and spending in other sectors of the economy, subject to the familiar multiplier effect (see below).

Internal rate of return The internal rate of return is the rate of interest which, when used to discount the cash flows associated with investing in education, reduces its net present value to zero, or where the present value of the revenues accruing from the investment are just equal to the present value of the costs incurred. This, in effect, is the breakeven rate of return on the investment since it shows the highest rate of interest at which the investment makes neither a profit nor a loss. IRR results are expressed as a percentage.

Multiplier In this report, multipliers are a measure of the overall regional earnings per dollar of earnings at the community college (i.e., per dollar of CC faculty and staff earnings). In our context, the multiplier can be defined as the total of on- and off-campus earnings divided by on-campus earnings. Multiplier effects are the result of in-area spending by the college on locally supplied goods and services, and of the local everyday spending of CC faculty and staff. We also include in the off-campus portion of the multiplier the added regional earnings attributable to past-students still active in the local labor force. The regional economy is larger because of the skills of these past students, and because of the added spending associated with their higher incomes, and from spending associated with the enlarged output of the industries where these past students are employed.

Net cash flow The NCF (net cash flow) is benefits minus costs.

Net present value	The net present value (NPV) is the discounted value of the revenues accruing from an investment minus the discounted value of the costs incurred. The net cash flow (benefits - costs) is discounted to the present by means of a discount rate. All future cash flows are collapsed into one number, which, if positive, indicates feasibility. The result is expressed as a monetary measure. If the NPV is positive, we have done better than alternative investment schemes, all else being equal.
Opportunity cost	The benefits foregone from alternative B once a decision is made to allocate resources to alternative A. Or, if an individual chooses not to attend college, he or she foregoes the higher future earnings associated with higher education. The benefit of higher education, therefore, is the "price tag" of choosing not to attend college.
Payback Period	This is a measure of the period of time required to recover an investment. The shorter the period, the more attractive is the investment. The formula for computing payback period is: Payback period = cost of investment/net return per period

Appendix 2: Explaining the Results—a Primer

The purpose of this appendix is to provide some context and meaning to investment analysis results in general, using the simple hypothetical example summarized in **Table 1** below. The table shows the projected (assumed) benefits and costs over time for one student and the associated investment analysis results.[39]

Table 1. Costs and Benefits

Year	Tuition	Opportunity Cost	Total Cost	Higher Earnings	NCF
1	2	3	4	5	6
1	$1,500	$20,000	$21,500	$0	($21,500)
2	$0	$0	$0	$5,000	$5,000
3	$0	$0	$0	$5,000	$5,000
4	$0	$0	$0	$5,000	$5,000
5	$0	$0	$0	$5,000	$5,000
6	$0	$0	$0	$5,000	$5,000
7	$0	$0	$0	$5,000	$5,000
8	$0	$0	$0	$5,000	$5,000
9	$0	$0	$0	$5,000	$5,000
10	$0	$0	$0	$5,000	$5,000
NPV			$20,673	$35,747	$15,074
IRR					18%
B/C Ratio					1.7
Payback Period					4.2 years

The assumptions are as follows:

1) The time horizon is 10 years— i.e., we project the benefits and costs out 10 years into the future (Column 1). Once the higher education has been earned, the benefits of higher earnings remain with the student into the future. Our objective is to measure these future benefits and compare them to the costs of the education.

2) The student attends the community college for one year for which he or she pays a tuition of $1,500 (Column 2).

[39] Note that this is a hypothetical example. The numbers used are not based on data collected from any of the community colleges.

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3) The opportunity cost of time (the earnings foregone while attending the community college for one year) for this student is estimated at $20,000 (Column 3).

4) Together, these two cost elements ($21,500 total) represent the out-of-pocket investment made by the student (Column 4).

5) In return, we assume that the student, having completed the one year of study, will earn $5,000 more per year than he would have without the education (Column 5).

6) Finally, the net cash flow column (NCF) in Column 6 shows higher earnings (Column 5) less the total cost (Column 4).

7) We assume a "going rate" of interest of 4%, the rate of return from alternative investment schemes, for the use of the $21,500.

Now the "mechanics"—we express the results in standard investment analysis terms: the net present value (NPV), the internal rate of return (IRR—or, as referred to in the Main Report, simply the rate of return—RR), the benefit/cost ratio (B/C), and the payback period. Each of these is briefly explained below in the context of the cash flow numbers in **Table 1**.

The Net Present Value (NPV)

"A bird in hand is worth two in the bush." This simple folk wisdom lies at the heart of any economic analysis of investments lasting more than one year. The student we are tracking in **Table 1** has choices: 1) to attend the community college, or 2) forget about higher education and hold on to the present employment. If he or she decides to enroll, certain economic implications unfold: the tuition must be paid and earnings will cease for one year. In exchange, the student calculates that, with the higher education, his or her income will increase by at least the $5,000 per year as indicated in the table.

The question is simple: will the prospective student be economically better off by choosing to enroll? If we add up the higher earnings of $5,000 per year for the remaining nine years in **Table 1**, the total will be $45,000. Compared to a total investment of $21,500, this appears to be a very solid investment. The reality, however, is different—

the benefits are far lower than $45,000 because future money is worth less than present money. The costs (tuition plus foregone earnings) are felt immediately because they are incurred today – in the present. The benefits (higher earnings), on the other hand, occur in the future. They are not yet available. We must discount all future benefits by the going rate of interest (referred to as the discount rate) to be able to express them in present value terms.[40] A brief example: at 4%, the present value of $5,000 to be received one year from today is $4,807. If the $5,000 were to be received in year 10, the present value would reduce to $3,377. Or put another way, $4,807 deposited in the bank today earning 4% interest will grow to $5,000 in one year; and $3,377 deposited today would grow to $5,000 in ten years. An "economically rational" person would, therefore, be equally satisfied receiving $3,377 today or $5,000 ten years from today given the going rate of interest of 4%. The process of discounting – finding the present value of future higher earnings – allows us to express values on an equal basis in future or present value terms.

Our goal is to express all future higher earnings in present value terms so that we can compare them to the investments incurred today – the tuition and foregone earnings. As indicated in **Table 1**, the cumulative present value of the flow of $5,000 worth of higher earnings between years 2 and 10 is $35,747 given the 4% interest rate, far lower than the undiscounted $45,000 discussed above.

The measure we are looking for is the NPV result of $15,074. It is simply the present value of the benefits less the present value of the costs, or $35,747 - $20,673 = $15,074. In other words, the present value of benefits exceeds the present value of costs by as much as $15,074. The criterion for an economically worthwhile investment is that the net present value is equal to or greater than zero. Given this result, it can be concluded that, *in this case*, and given these assumptions, this particular investment in CC education is very strong.

The Internal Rate of Return (IRR)

The internal rate of return is another way of measuring the worth of the investment in education using the same cash flows shown in **Table 1**. In technical terms – the internal

[40] Technically, the **interest rate** is applied to compounding – the process of looking at deposits today and determining how much they will be worth in the future. The same interest rate is called a **discount rate** when we reverse the process – determining the present value of future earnings.

rate of return is a measure of the average earning power of the money used over the life of the investment. It is simply the interest rate that makes the net present value equal to zero. In the NPV example above we applied the "going rate" of interest of 4% and computed a positive net present value of $15,074. The question now is: what would the interest rate have to be in order to reduce the net present value to zero? Obviously it would have to be higher—18% in fact, as indicated in **Table 1**. Or, if we applied 18% to the NPV calculations instead of the 4%, then the net present value would reduce to zero.

What does this mean? The internal rate of return of 18% defines a breakeven solution—the point where the present value of benefits just equals the present value of costs, or where the net present value equals zero. Or, at 18%, the higher incomes of $5,000 per year for the next nine years will earn back all the investments of $21,500 made plus pay 18% for the use of that money (the $21,500) in the meantime. Is this a good return? Indeed it is—first, if we compare it to the 4% "going rate" of interest we applied to the NPV calculations, 18% is far higher than 4%. We can conclude, therefore, that the investment in this case is solid. Alternatively, we can compare the rate to the long-term 7% rate or so obtained from investments in stocks and bonds. Again, the 18% is far higher, indicating that the investment in CC education is strong relative to the stock market returns (on average).

A word of caution—the IRR approach can sometimes generate "wild" or "unbelievable" results—percentages that defy the imagination. Technically, the approach requires at least one negative cash flow (tuition plus opportunity cost of time) to offset all subsequent positive flows. For example, if the student works full time while attending college, the opportunity cost of time would be much lower—the only out-of-pocket cost would be the $1,500 paid for tuition. In this case, it is still possible to compute the internal rate of return, but it would be a staggering 333% because only a negative $1,500 cash flow will be offsetting 9 subsequent years of $5,000 worth of higher earnings. The 333% return is technically correct, but not consistent with conventional understanding of returns expressed as percentages. For purposes of this report, therefore, we express all results in the Main Report exceeding 100% simply as "NA" or "> than 100%."

The Benefit/Cost Ratio (B/C)

The benefit/cost ratio is simply the present value of benefits divided by present value of costs, or $35,747 / $21,500 = 1.7 (based on the 4% discount rate). Of course, any change

in the discount rate will also change the benefit/cost ratio. If we applied the 18% internal rate of return discussed above, the benefit/cost ratio would reduce to 1.0—or the breakeven solution where benefits just equal the costs. Applying a discount rate higher than the 18% would reduce the ratio to less than one and the investment would not be feasible. The 1.7 ratio means that a dollar invested today will return a **cumulative** $1.70 over the ten year time period.

The Payback Period

This is the length of time from the beginning of the investment (consisting of the tuition plus the earnings foregone) until the higher future earnings return the investments made. In **Table 1**, it will take roughly 4.2 years of $5,000 worth of higher earnings to recapture the student's investment of $1,500 in tuition and the $20,000 earnings he or she foregoes while attending the community college. The higher earnings occurring *beyond* the 4.2 years are the returns (the "gravy") that make the investment in education *in this example* economically worthwhile. The payback period is a fairly rough, albeit common, means of choosing between investments. The shorter the payback period, the stronger the investment.

Appendix 3: Methodology for Creating Income Gains by Levels of Education

The US Bureau of the Census reports income in two ways:

1) Mean income by race and Hispanic origin and by sex.

2) Educational attainment by mean income and sex.

The first and second data sets can be found at the following sources:

U.S. Census Bureau and U.S. Department of Commerce. Table P-3: Race and Hispanic Origin of People by Mean Income and Sex: 1947 to 2000, and Table P-18: Educational Attainment--People 25 Years Old and Over by Mean Income and Sex: 1991 to 2000. Also consult:

http://www.census.gov/ftp/pub/hhes/income/histinc/histinctb.html

Further contact information: 1) Income Surveys Branch, 2) Housing and Household Economic Statistics Division, 3) U.S. Census Bureau, and 4) U.S. Department of Commerce.

The data needed for this analysis is mean income by educational attainment reported by race/ethnic origin and by sex. A model was developed to translate these two data sets into the data needed for the analysis. This was accomplished in the following way:

1. Mean income by race and sex is calculated as a percent of all races.
2. This percent is then applied to mean income by educational attainment. For example, African-American males make an average income of $28,392 versus $40,293 for all males, or 70% of the average income of all males.
3. This percent (70%) is then applied to the income levels by educational attainment for all males to estimate the income levels by educational attainment for African-American males.

4. To simplify the analysis, all minority males are averaged together as are all minority females. The same process is repeated for white males and white females.

5. The educational levels of attainment are aggregated together in some categories to model the educational system of community colleges. These numbers are then adjusted for inflation to current year dollars.

6. The final step is to adjust these income levels by state. The *Four Person Median Family Income by State* from the Bureau of the Census was used to make state level adjustments. Each state's median family income is taken as a percentage of the national average. These percentages are then applied to the income levels by educational attainment by race, ethnicity, and sex, as calculated earlier.

Appendix 4: Adjusting for the Benefits Available Absent State and Local Government Support

Introduction

The investment analysis presented in the Main Report weighs the benefits of CC enrollment (measured in terms of CHEs) against the support provided by state and local government. If, without state and local government support a community college would have to shut its doors, then it is entirely appropriate to credit all the benefits to that support. This brings up the question: is it in fact true that the community college would have to close its doors absent state and local government support? Increased tuition could almost certainly make up for some of the lost funds, although this would result in reduced enrollment. Still, if the school could remain open and operate at this "zero state and local government support level," then state and local government support can only be credited with the difference (i.e., the actual enrollment less the enrollment at zero state and local government support). This appendix documents our procedures for making these adjustments, which feed the broad and narrow taxpayer benefit/cost ratios, rates of return, and payback analyses estimates in the Main Report.

State and Local Government Support Versus Tuition

We start by exploring the issue with the aid of some graphics. **Figure 1** presents a simple model of student demand and state and local government support. The right side of the graph is a standard demand curve (D) showing student enrollment as a function of tuition and other student fees. Enrollment is measured in total CHEs and expressed as a percentage of current CHEs. The current tuition rate is p', and state and local government support covers C% of all costs. At this point in the analysis, we assume that the CC has only two sources of revenues, student tuition payments and state and local government support.

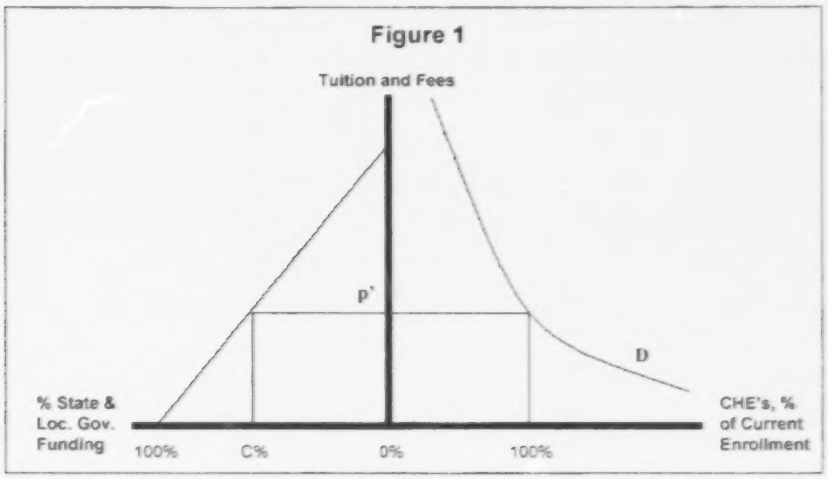
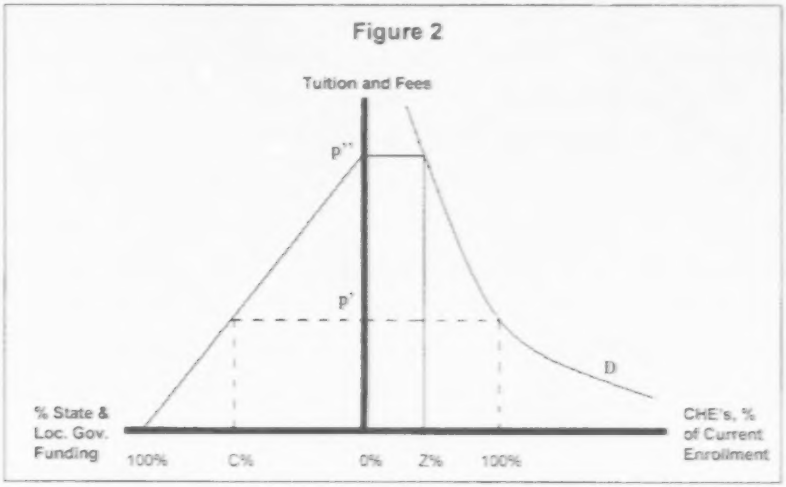


Figure 2 shows another important reference point in the model—where state and local government support is 0%, tuition rates are increased to p", and enrollment is Z% (less than 100%). The reduction in enrollment reflects price elasticity in the students' school vs. no-school decision. Neglecting for the moment those issues concerning the CC's minimum operating scale (considered below in the section on "The CC Shutdown Point"), the implication for our investment analysis is that the benefits of state and local government support for the CC must be adjusted to net out the benefits associated with a level of enrollment at Z% (i.e., the school can provide these benefits absent state and local government support).



From Enrollment to Benefits

This appendix is mainly focused on the size of CC enrollment (i.e., the production of CHEs) and its relationship to student versus state and local government funding. However, to clarify the argument it is useful to briefly consider the role of enrollment in our larger benefit/cost model.

Let B equal the benefits attributable to state and local government support. B might be understood as applying to either our broad or narrow taxpayer perspectives. The analysis in the Main Report derives all benefits as a function of student enrollments (i.e., CHEs). For consistency with the graphical exposition elsewhere in this appendix, B will be expressed as a function of the percent of current enrollment (i.e., percent of current CHEs). Accordingly, the equation

(1) $B = B(100\%)$

reflects the total benefits generated by enrollments at their current levels, measured in our Main Report and shown in **Table 3.7** for the broad taxpayer perspective, and in **Table 3.8** for the narrow taxpayer perspective.

Consider benefits now with reference to **Figure 2**. The point where state and local government support is zero nonetheless provides for Z% (less than 100%) of the current enrollment, and benefits are symbolically indicated by:

(2) $B = B(Z\%)$

Inasmuch as the benefits in (2) occur with or without state and local government support, the benefits appropriately attributed to state and local government support is given by:

(3) $B = B(100\%) - B(Z\%)$

The CC Shutdown Point

CC operations will cease when fixed costs can no longer be covered. The shutdown point is introduced graphically in **Figure 3** as S%. The location of point S% indicates

that this particular college can operate at an even lower enrollment level than Z% (the point of zero state and local funding). At point S%, state and local government support is still zero, and the tuition rate has been raised to p'''. At tuition rates still higher than p''', the CC would not be able to attract enough students the keep the doors open, and it would shut down. In **Figure 3**, point S% illustrates the CC shutdown point but otherwise plays no role in the estimation of state and local government benefits. These remain as shown in equation (3).

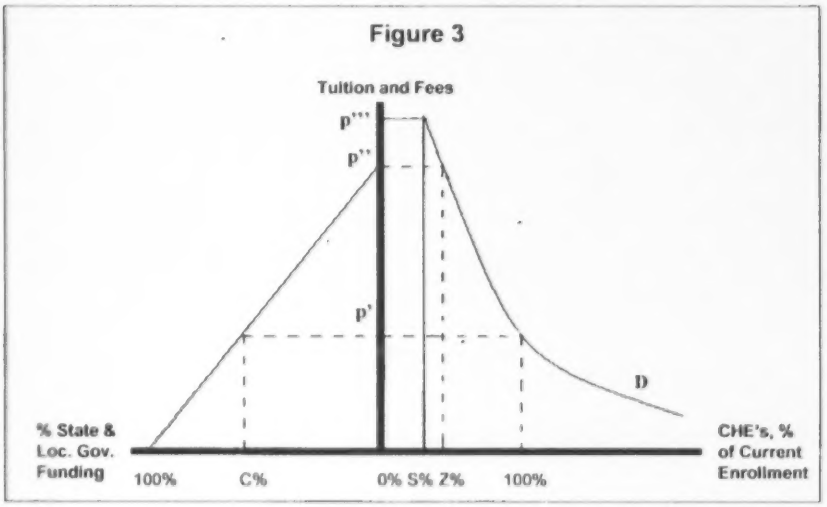
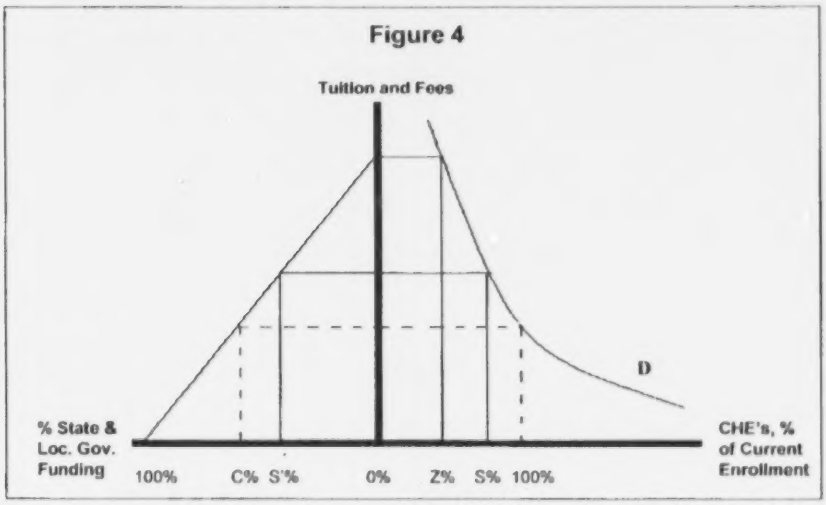


Figure 4 illustrates yet another scenario. Here the CC shutdown point occurs at an enrollment level greater than Z% (the level of zero state and local government support), meaning some minimum level of state and local government support is needed for the school to operate at all. This minimum portion of overall funding is indicated by S'% on the left side of the chart, and as before, the shutdown point is indicated by S% on the right side of chart. In this case, state and local government support is appropriately credited all the benefits generated by CC enrollment, or B=B(100%).

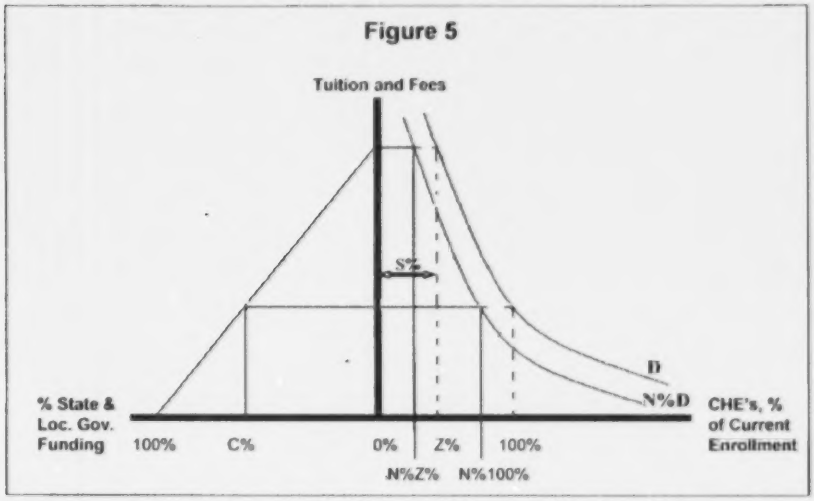


ADJUSTING FOR ALTERNATIVE EDUCATION OPPORTUNITIES

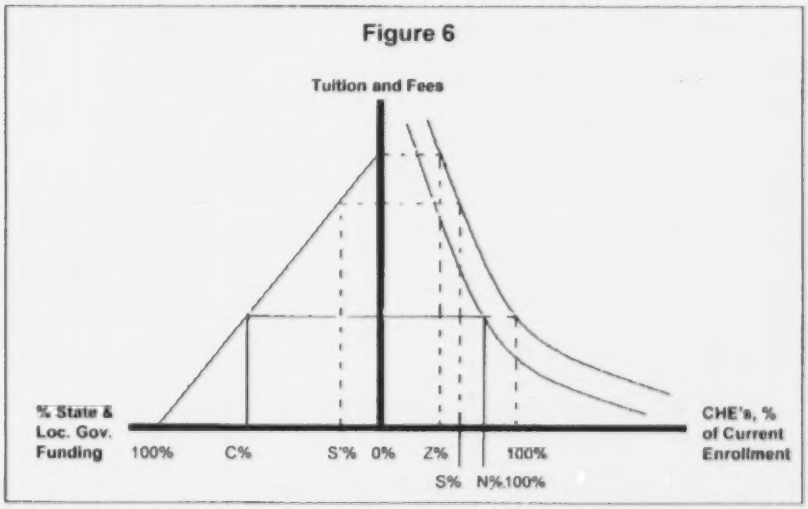
Because there may be education alternatives to the CC, we must make yet another adjustment. The question asked is: "Absent the community colleges, what percentage of the students would be able to obtain their education elsewhere?" The benefits associated with the CC education of these students are deducted from the overall benefit estimates.

The adjustment for alternative education is easily incorporated into our simple graphic model. For simplicity, let A% equal the percent of students with alternative education opportunities, and N% equal the percent of students without an alternative. Note that: N% + A% = 100%. **Figure 5** presents the case where the CC could operate absent state and local government support (i.e., Z% occurs at an enrollment level greater than the CC shutdown level S%). In this case, the benefits generated by enrollments absent state and local government support must be subtracted from total benefits. This case is parallel to that indicated in equation (3), and the net benefits attributable to state and local government support is given by:

(4) $B = B(N\%100\%) - B(N\%Z\%)$



Finally, **Figure 6** presents the case where the CC cannot remain open absent some minimum S'% level of state and local government support. In this case the CC is credited with all benefits generated by current enrollment, less only the percent of students with alternative education opportunities. These benefits are represented symbolically as B(N%100%).



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MACC Maryland Association of Community Colleges

The Socioeconomic Benefits Generated by 16 Community Colleges in Maryland

State of Maryland

Volume 2: Detailed Results

by

Entry Level of Education

Gender and Ethnicity

June 30, 2003

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INTRODUCTION

The purpose of this volume is to present the results of the economic impact analysis in detail by gender, ethnicity, and entry level of education. It is kept as a separate volume intended for limited distribution only, however, because this effort is not about gender and ethnicity differences *per se*. The study is about the overall economic impacts generated by community colleges (CCs). As such, the Main Report and the short Executive Summary both present the results without reference to gender and ethnicity differences.

We feel, nevertheless, that it is important to present *all* of the results for the sake of completeness, not just the consolidated ones, so long as the users of the detailed information remain prudent in its use and distribution. The results should not be used, for example, to further political agendas. Other studies about gender and ethnicity differences address such questions better and in greater detail. Our intent is simply to provide CC presidents with pertinent information should specific questions arise.

On the input side, gender and ethnicity are important variables that help characterize the student body profile. We collect the profile data and link it to national statistical databases which are already broken out by gender and ethnic differences. The student body profile, to a large extent, drives the magnitudes of the results which are presented in detail in this volume and in a consolidated fashion in the Main Report and the Executive Summary.

Tables 19 and **20** in this report are particularly important. They provide the data needed for computing the investment analysis results in **Tables 3.7** and **3.8** in the **Main Report** – the broad and narrow taxpayer perspectives. In **Table 19**, every other column (the higher taxes and the avoided cost columns) provides the data needed for the narrow taxpayer perspective. The remaining columns provide the data needed for the broad taxpayer perspective. **Table 20** provides the detailed calculations on student earnings that feed into the first column of **Table 19**.

DETAILED RESULTS

Table 1. Higher Annual Earnings Based on Achievements During Analysis Year, Aggregate

	Male		Female		
	White	Minority	White	Minority	Total
< HS/GED	$6,974,439	$3,330,877	$5,905,207	$3,047,725	$19,258,248
HS/GED equivalent	$8,790,233	$4,198,070	$7,509,095	$3,875,505	$24,372,903
One year post HS or less	$70,545,212	$30,220,564	$63,463,047	$41,736,201	$205,965,023
Two years post HS or less	$72,192,545	$25,832,079	$64,829,177	$37,660,441	$200,514,241
> Associate Degree	$35,571,109	$10,303,643	$34,956,612	$15,493,235	$96,324,599
Total	$194,073,538	$73,885,232	$176,663,138	$101,813,108	$546,435,015

Table 2. No. of Days Reduced Absenteeism/Year

	Male		Female		Reduce
	White	Minority	White	Minority	Absent.
< HS/GED	1,294	1,287	2,534	3,439	8,554
HS/GED equivalent	586	583	1,148	1,558	3,875
One year post HS or less	10,172	9,113	21,084	36,532	76,902
Two years post HS or less	5,067	3,795	10,387	15,976	35,225
> Associate Degree	2,155	1,299	4,841	5,642	13,937
Total	19,274	16,077	39,996	63,146	138,493

Table 3. Employer Savings from Reduced Absenteeism, $ per Year

	Male		Female		
	White	Minority	White	Minority	Total
< HS/GED	$151,200	$92,839	$152,291	$165,857	$562,187
HS/GED equivalent	$105,350	$64,687	$109,603	$119,367	$399,008
One year post HS or less	$2,113,177	$1,169,350	$2,346,300	$3,262,856	$8,891,684
Two years post HS or less	$1,233,342	$570,447	$1,366,198	$1,686,392	$4,856,379
> Associate Degree	$595,657	$221,830	$727,676	$680,569	$2,225,732
Total	$4,198,726	$2,119,154	$4,702,069	$5,915,042	$16,934,990

Table 4. Fewer Smokers

	Male		Female		
	White	Minority	White	Minority	Total
< HS/GED	34	4	37	5	80
HS/GED equivalent	24	3	27	4	58
One year post HS or less	552	68	666	137	1,424
Two years post HS or less	362	44	442	93	940
> Associate Degree	168	18	228	40	454
Total	1,139	137	1,400	279	2,956

Table 5. Medical Savings from Reduced Smoking, $ per Year

	Annual Costs, Male		Annual Costs, Female		
	White	Minority	White	Minority	Total
< HS/GED	$99,318	$11,617	$110,421	$15,633	$236,990
HS/GED equivalent	$71,137	$8,888	$79,868	$11,937	$171,830
One year post HS or less	$1,635,693	$201,892	$1,973,057	$406,822	$4,217,463
Two years post HS or less	$1,071,077	$130,555	$1,308,935	$274,231	$2,784,797
> Associate Degree	$497,410	$54,319	$676,371	$117,256	$1,345,355
Total	$3,374,634	$407,272	$4,148,652	$825,878	$8,756,435

Table 6. Fewer Alcohol Abusers

	Male		Female		
	White	Minority	White	Minority	Total
< HS/GED	8	6	8	4	26
HS/GED equivalent	6	4	6	3	19
One year post HS or less	140	98	137	94	469
Two years post HS or less	102	59	86	56	303
> Associate Degree	51	24	43	22	140
Total	306	191	280	180	956

Table 7. Medical Savings from Reduced Alcohol Abuse, $ per Year

	Annual Costs, Male		Annual Costs, Female		
	White	Minority	White	Minority	Total
< HS/GED	$60,645	$47,508	$64,227	$32,471	$204,851
HS/GED equivalent	$45,359	$35,419	$45,464	$23,609	$149,851
One year post HS or less	$1,109,943	$775,032	$1,089,097	$749,509	$3,723,581
Two years post HS or less	$809,982	$469,545	$684,670	$446,949	$2,411,145
> Associate Degree	$402,956	$187,435	$341,885	$176,714	$1,108,990
Total	$2,428,885	$1,514,940	$2,225,343	$1,429,251	$7,598,419

Table 8. Fewer Incarcerated, Aggregate for Student Body

	Male		Female		
	White	Minority	White	Minority	Total
< HS/GED	9.7	9.3	0.2	2.0	21.1
HS/GED equivalent	5.5	6.4	0.1	1.3	13.3
One year post HS or less	94.2	125.8	1.7	36.1	257.7
Two years post HS or less	35.7	63.0	0.6	16.7	116.1
> Associate Degree	11.6	22.2	0.2	5.6	39.6
Total	157	227	3	62	448

Table 9. Savings from Reduced Incarceration, $ per Year

	Annual Costs, Male		Annual Costs, Female		
	White	Minority	White	Minority	Total
< HS/GED	$91,454	$87,661	$1,545	$18,862	$199,522
HS/GED equivalent	$52,350	$60,541	$884	$12,385	$126,159
One year post HS or less	$890,808	$1,189,599	$15,903	$341,122	$2,437,432
Two years post HS or less	$338,051	$595,628	$5,957	$158,261	$1,097,898
> Associate Degree	$109,492	$210,253	$2,115	$53,106	$374,966
Total	$1,482,155	$2,143,683	$26,403	$583,736	$4,235,976

Table 10. Crime Victim Savings, Aggregate for Student Body, $ per Year

	Annual Costs, Male		Annual Costs, Female		
	White	Minority	White	Minority	Total
< HS/GED	$100,723	$96,546	$1,701	$20,773	$219,743
HS/GED equivalent	$57,655	$66,677	$973	$13,640	$138,945
One year post HS or less	$981,091	$1,310,165	$17,515	$375,695	$2,684,466
Two years post HS or less	$372,313	$655,995	$6,561	$174,301	$1,209,170
> Associate Degree	$120,589	$231,562	$2,329	$58,488	$412,969
Total	$1,632,371	$2,360,945	$29,079	$642,897	$4,665,293

Table 11. Productivity Gained (Fewer Incarcerated), $ per Year

	Annual Costs, Male		Annual Costs, Female		
	White	Minority	White	Minority	Total
< HS/GED	$41,992	$24,860	$369	$3,620	$70,841
HS/GED equivalent	$31,687	$22,633	$284	$3,197	$57,800
One year post HS or less	$590,905	$487,372	$5,634	$96,993	$1,180,904
Two years post HS or less	$260,193	$283,148	$2,469	$52,649	$598,459
> Associate Degree	$95,875	$113,708	$1,004	$20,234	$230,821
Total	$1,020,652	$931,722	$9,760	$176,691	$2,138,825

Table 12. Fewer People on Welfare

	Male		Female		
	White	Minority	White	Minority	Total
< HS/GED	7.5	13.1	58.9	85.2	164.7
HS/GED equivalent	4.5	7.9	35.3	51.2	98.9
One year post HS or less	81.7	128.2	676.9	1251.3	2138.0
Two years post HS or less	34.7	45.6	284.6	467.8	832.8
> Associate Degree	12.2	12.8	109.2	135.8	270.0
Total	141	208	1,165	1,991	3,504

Table 13. Community Welfare Savings, $ per Year

	Annual Costs, Male		Annual Costs, Female		
	White	Minority	White	Minority	Total
< HS/GED	$33,690	$58,635	$263,746	$381,739	$737,810
HS/GED equivalent	$20,229	$35,207	$158,363	$229,210	$443,008
One year post HS or less	$365,999	$574,219	$3,033,000	$5,606,464	$9,579,682
Two years post HS or less	$155,697	$204,456	$1,275,191	$2,095,984	$3,731,327
> Associate Degree	$54,484	$57,514	$489,435	$608,343	$1,209,776
Total	$630,097	$930,031	$5,219,735	$8,921,739	$15,701,602

Table 14. Fewer People on Unemployment

	Male		Female		
	White	Minority	White	Minority	Total
< HS/GED	22	31	42	49	143
HS/GED equivalent	19	26	36	42	123
One year post HS or less	68	175	137	410	791
Two years post HS or less	26	53	51	134	265
> Associate Degree	16	28	36	72	153
Total	150	313	302	708	1,474

Table 15. Unemployment Savings, $ per Year

	Annual Costs, Male		Annual Costs, Female		
	White	Minority	White	Minority	Total
< HS/GED	$201,975	$284,837	$387,488	$454,437	$1,328,738
HS/GED equivalent	$173,378	$244,508	$332,624	$390,094	$1,140,604
One year post HS or less	$631,983	$1,624,385	$1,276,112	$3,811,038	$7,343,519
Two years post HS or less	$236,834	$495,258	$477,173	$1,247,575	$2,456,840
> Associate Degree	$152,139	$258,803	$334,918	$670,830	$1,416,690
Total	$1,396,310	$2,907,791	$2,808,315	$6,573,975	$13,686,390

Table 16. Summary of Annual Impacts, $ per Year

	Male		Female		
	White	Minority	White	Minority	Total
Higher earnings	$194,073,538	$73,885,232	$176,663,138	$101,813,108	$546,435,015
Absenteeism Savings	$4,198,726	$2,119,154	$4,702,069	$5,915,042	$16,934,990
Medical Cost Savings	$5,803,519	$1,922,211	$6,373,994	$2,255,129	$16,354,854
Incarceration Savings	$1,482,155	$2,143,683	$26,403	$583,736	$4,235,976
Crime Victim Savings	$1,632,371	$2,360,945	$29,079	$642,897	$4,665,293
Add Prod. (fewer incarc.)	$1,020,652	$931,722	$9,760	$176,691	$2,138,825
Welfare Savings	$630,097	$930,031	$5,219,735	$8,921,739	$15,701,602
Unemployment Savings	$1,396,310	$2,907,791	$2,808,315	$6,573,975	$13,686,390
Total	$210,237,369	$87,200,768	$195,832,493	$126,882,316	$620,152,946

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Table 17. Annual Impacts per Credit Hour Equivalent, $ per Year

	Male		Female		Weighted
	White	Minority	White	Minority	Average
Higher earnings	$ 237	$ 150	$ 132	$ 108	$ 152
Absenteeism Savings	$ 5	$ 4	$ 4	$ 6	$ 5
Medical Cost Savings	$ 7	$ 4	$ 5	$ 2	$ 5
Incarceration Savings	$ 2	$ 4	$ 0	$ 1	$ 1
Crime Victim Savings	$ 2	$ 5	$ 0	$ 1	$ 1
Add Prod. (fewer incarc.)	$ 1	$ 2	$ 0	$ 0	$ 1
Welfare Savings	$ 1	$ 2	$ 4	$ 9	$ 4
Unemployment Savings	$ 2	$ 6	$ 2	$ 7	$ 4
Total	$ 256	$ 177	$ 147	$ 134	$ 173

Table 18. Annual Impacts per Student, $ per Year

	Male		Female		Weighted
	White	Minority	White	Minority	Average
Higher earnings	$ 2,235	$ 1,413	$ 1,251	$ 1,018	$ 1,436
Absenteeism Savings	$ 48	$ 41	$ 33	$ 59	$ 45
Medical Cost Savings	$ 67	$ 37	$ 45	$ 23	$ 43
Incarceration Savings	$ 17	$ 41	$ 0	$ 6	$ 11
Crime Victim Savings	$ 19	$ 45	$ 0	$ 6	$ 12
Add Prod. (fewer incarc.)	$ 12	$ 18	$ 0	$ 2	$ 6
Welfare Savings	$ 7	$ 18	$ 37	$ 89	$ 41
Unemployment Savings	$ 16	$ 56	$ 20	$ 66	$ 36
Total	$ 2,421	$ 1,668	$ 1,386	$ 1,268	$ 1,630

Table 19. Cumulative Impact Over Time ($ Thousands), Details for Both Taxpayer Perspectives

			Health				Crime						Welfare / Unemployment			
Year	Earnings Net	Added Taxes	Reduced Absent.	Avoided Cost	Medical Saving	Avoided Cost	Incarc-eration	Avoided Cost	Victims	Avoided Cost	Product. Gained	Avoided Cost	Reduced Welfare	Avoided Cost	Reduced Unempl.	Avoided Cost
1	$902,433	$125,673	$15,949	$1,794	$15,403	$924	$3,989	$3,191	$4,394	$0	$2,014	$281	$14,787	$2,366	$12,889	$0
2	$164,094	$22,852	$15,841	$1,782	$15,253	$915	$3,951	$3,160	$4,351	$0	$2,001	$279	$14,644	$2,343	$12,739	$0
3	$241,408	$33,619	$15,734	$1,770	$15,104	$906	$3,912	$3,130	$4,309	$0	$1,987	$277	$14,501	$2,320	$12,590	$0
4	$258,287	$35,969	$15,628	$1,758	$14,958	$897	$3,874	$3,099	$4,267	$0	$1,974	$275	$14,360	$2,298	$12,443	$0
5	$275,413	$38,354	$15,523	$1,746	$14,812	$889	$3,836	$3,069	$4,225	$0	$1,960	$273	$14,221	$2,275	$12,297	$0
6	$292,704	$40,762	$15,418	$1,734	$14,668	$880	$3,799	$3,039	$4,184	$0	$1,947	$271	$14,082	$2,253	$12,153	$0
7	$310,072	$43,181	$15,314	$1,722	$14,526	$872	$3,762	$3,010	$4,143	$0	$1,934	$269	$13,945	$2,231	$12,011	$0
8	$327,426	$45,597	$15,210	$1,711	$14,384	$863	$3,726	$2,980	$4,103	$0	$1,921	$268	$13,810	$2,210	$11,871	$0
9	$344,669	$47,999	$15,108	$1,699	$14,245	$855	$3,689	$2,952	$4,063	$0	$1,908	$266	$13,676	$2,188	$11,732	$0
10	$361,703	$50,371	$15,006	$1,688	$14,106	$846	$3,654	$2,923	$4,024	$0	$1,895	$264	$13,543	$2,167	$11,595	$0
11	$378,427	$52,700	$14,904	$1,676	$13,969	$838	$3,618	$2,894	$3,985	$0	$1,882	$262	$13,411	$2,146	$11,459	$0
12	$394,738	$54,971	$14,804	$1,665	$13,833	$830	$3,583	$2,866	$3,946	$0	$1,870	$260	$13,281	$2,125	$11,325	$0
13	$410,534	$57,171	$14,704	$1,654	$13,699	$822	$3,548	$2,838	$3,908	$0	$1,857	$259	$13,151	$2,104	$11,193	$0
14	$425,715	$59,285	$14,605	$1,643	$13,565	$814	$3,514	$2,811	$3,870	$0	$1,845	$257	$13,024	$2,084	$11,062	$0
15	$440,181	$61,300	$14,506	$1,632	$13,434	$806	$3,479	$2,783	$3,832	$0	$1,832	$255	$12,897	$2,064	$10,933	$0
16	$453,838	$63,201	$14,408	$1,621	$13,303	$798	$3,446	$2,756	$3,795	$0	$1,820	$253	$12,772	$2,043	$10,805	$0
17	$466,592	$64,978	$14,311	$1,610	$13,174	$790	$3,412	$2,730	$3,758	$0	$1,807	$252	$12,647	$2,024	$10,679	$0
18	$478,359	$66,616	$14,214	$1,599	$13,046	$783	$3,379	$2,703	$3,721	$0	$1,795	$250	$12,524	$2,004	$10,554	$0
19	$489,058	$68,106	$14,118	$1,588	$12,919	$775	$3,346	$2,677	$3,685	$0	$1,783	$248	$12,403	$1,984	$10,430	$0
20	$498,616	$69,437	$14,023	$1,577	$12,793	$768	$3,313	$2,651	$3,649	$0	$1,771	$247	$12,282	$1,965	$10,308	$0
21	$506,968	$70,600	$13,928	$1,567	$12,669	$760	$3,281	$2,625	$3,614	$0	$1,759	$245	$12,163	$1,946	$10,188	$0
22	$514,058	$71,588	$13,834	$1,556	$12,546	$753	$3,249	$2,599	$3,579	$0	$1,747	$243	$12,044	$1,927	$10,069	$0
23	$519,840	$72,393	$13,741	$1,546	$12,424	$745	$3,218	$2,574	$3,544	$0	$1,735	$242	$11,927	$1,908	$9,951	$0
24	$518,568	$72,216	$13,648	$1,535	$12,303	$738	$3,186	$2,549	$3,509	$0	$1,724	$240	$11,811	$1,890	$9,835	$0
25	$521,884	$72,678	$13,556	$1,525	$12,183	$731	$3,156	$2,524	$3,475	$0	$1,712	$238	$11,697	$1,871	$9,720	$0
26	$523,814	$72,946	$13,465	$1,514	$12,065	$724	$3,125	$2,500	$3,442	$0	$1,701	$237	$11,583	$1,853	$9,606	$0
27	$524,351	$73,021	$13,374	$1,504	$11,947	$717	$3,094	$2,476	$3,408	$0	$1,689	$235	$11,470	$1,835	$9,494	$0
28	$373,839	$52,061	$13,283	$1,494	$11,831	$710	$3,064	$2,451	$3,375	$0	$1,678	$234	$11,359	$1,817	$9,383	$0
29	$362,033	$50,417	$13,194	$1,484	$11,716	$703	$3,035	$2,428	$3,342	$0	$1,666	$232	$11,248	$1,800	$9,273	$0
30	$340,319	$47,393	$13,105	$1,474	$11,602	$696	$3,005	$2,404	$3,310	$0	$1,655	$230	$11,139	$1,782	$9,165	$0
31	$335,062	$46,661	$13,016	$1,464	$11,490	$689	$2,976	$2,381	$3,277	$0	$1,644	$229	$11,031	$1,765	$9,057	$0
32	$185,199	$25,791	$12,928	$1,454	$11,378	$683	$2,947	$2,358	$3,246	$0	$1,633	$227	$10,923	$1,748	$8,952	$0
33	$166,988	$23,255	$12,841	$1,444	$11,267	$676	$2,918	$2,335	$3,214	$0	$1,622	$226	$10,817	$1,731	$8,847	$0
34	$136,844	$19,057	$12,754	$1,435	$11,158	$669	$2,890	$2,312	$3,183	$0	$1,611	$224	$10,712	$1,714	$8,743	$0
35	$136,394	$18,994	$12,668	$1,425	$11,049	$663	$2,862	$2,289	$3,152	$0	$1,600	$223	$10,608	$1,697	$8,641	$0
36	$135,571	$18,880	$12,583	$1,415	$10,942	$657	$2,834	$2,267	$3,121	$0	$1,589	$221	$10,505	$1,681	$8,540	$0
37	$134,383	$18,714	$12,498	$1,406	$10,835	$650	$2,806	$2,245	$3,091	$0	$1,578	$220	$10,403	$1,664	$8,440	$0
38	$132,842	$18,500	$12,413	$1,396	$10,730	$644	$2,779	$2,223	$3,061	$0	$1,568	$218	$10,302	$1,648	$8,342	$0
39	$0	$0	$12,330	$1,387	$10,626	$638	$2,752	$2,202	$3,031	$0	$1,557	$217	$10,201	$1,632	$8,244	$0
PV	$7,408,579	$1,031,719	$284,406	$31,989	$263,930	$15,836	$68,359	$54,687	$75,287	$0	$35,919	$5,002	$253,388	$40,542	$215,208	$0

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Table 20. Earnings Calculations, Taxpayer Perspectives ($ Thousands)

Year	Gross Student Earnings	Net of Attrition	Direct Earnings Net	Indirect Student Earnings	Net Total Student Earnings	Total CC Earnings	Total Earnings Net
1	$258,994	$246,478	$81,338	$65,657	$146,995	$755,438	$902,433
2	$291,644	$275,149	$90,799	$73,294	$164,094	$0	$164,094
3	$432,535	$404,789	$133,580	$107,828	$241,408	$0	$241,408
4	$466,156	$433,090	$142,920	$115,367	$258,287	$0	$258,287
5	$500,655	$461,807	$152,396	$123,016	$275,413	$0	$275,413
6	$535,889	$490,800	$161,964	$130,740	$292,704	$0	$292,704
7	$571,703	$519,923	$171,575	$138,498	$310,072	$0	$310,072
8	$607,928	$549,022	$181,177	$146,249	$327,426	$0	$327,426
9	$644,384	$577,935	$190,719	$153,951	$344,669	$0	$344,669
10	$680,881	$606,497	$200,144	$161,559	$361,703	$0	$361,703
11	$717,219	$634,539	$209,398	$169,029	$378,427	$0	$378,427
12	$753,193	$661,889	$218,423	$176,314	$394,738	$0	$394,738
13	$788,592	$688,376	$227,164	$183,370	$410,534	$0	$410,534
14	$823,200	$713,831	$235,564	$190,151	$425,715	$0	$425,715
15	$856,803	$738,088	$243,569	$196,612	$440,181	$0	$440,181
16	$889,186	$760,986	$251,126	$202,712	$453,838	$0	$453,838
17	$920,141	$782,373	$258,183	$208,409	$466,592	$0	$466,592
18	$949,461	$802,103	$264,694	$213,665	$478,359	$0	$478,359
19	$976,950	$820,043	$270,614	$218,444	$489,058	$0	$489,058
20	$1,002,423	$836,069	$275,903	$222,713	$498,616	$0	$498,616
21	$1,025,706	$850,074	$280,525	$226,443	$506,968	$0	$506,968
22	$1,046,638	$861,963	$284,448	$229,610	$514,058	$0	$514,058
23	$1,065,078	$871,658	$287,647	$232,193	$519,840	$0	$519,840
24	$1,058,850	$869,525	$286,943	$231,625	$518,568	$0	$518,568
25	$1,072,195	$875,086	$288,778	$233,106	$521,884	$0	$521,884
26	$1,082,784	$878,322	$289,846	$233,968	$523,814	$0	$523,814
27	$1,090,551	$879,222	$290,143	$234,208	$524,351	$0	$524,351
28	$798,307	$626,846	$206,859	$166,980	$373,839	$0	$373,839
29	$777,338	$607,049	$200,326	$161,706	$362,033	$0	$362,033
30	$742,238	$570,640	$188,311	$152,007	$340,319	$0	$340,319
31	$735,740	$561,826	$185,403	$149,660	$335,062	$0	$335,062
32	$408,738	$310,538	$102,478	$82,721	$185,199	$0	$185,199
33	$362,746	$280,002	$92,401	$74,587	$166,988	$0	$166,988
34	$308,258	$229,457	$75,721	$61,123	$136,844	$0	$136,844
35	$308,985	$228,703	$75,472	$60,922	$136,394	$0	$136,394
36	$308,857	$227,323	$75,017	$60,554	$135,571	$0	$135,571
37	$307,880	$225,331	$74,359	$60,024	$134,383	$0	$134,383
38	$306,066	$222,747	$73,506	$59,335	$132,842	$0	$132,842
39	$0	$0	$0	$0	$0	$0	$0

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